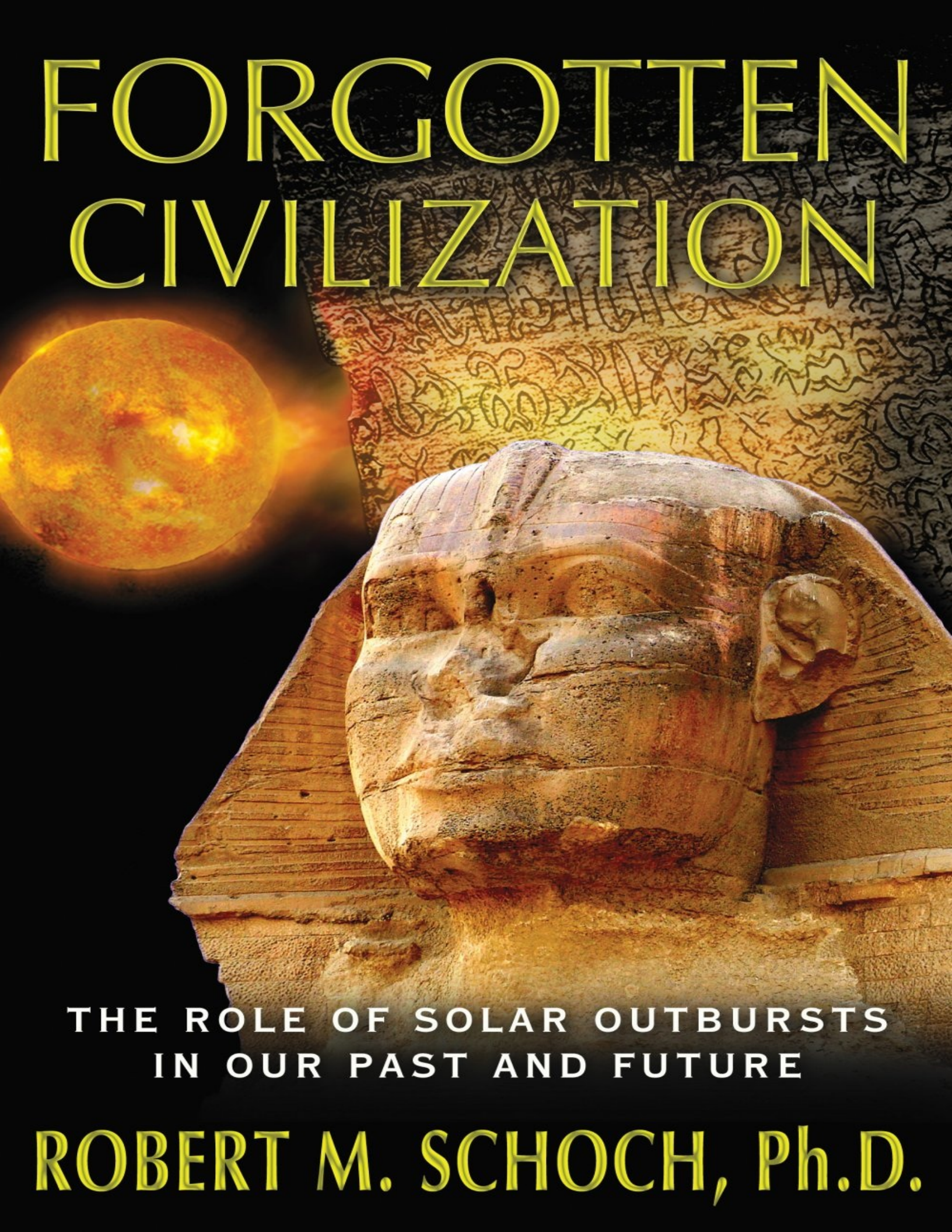
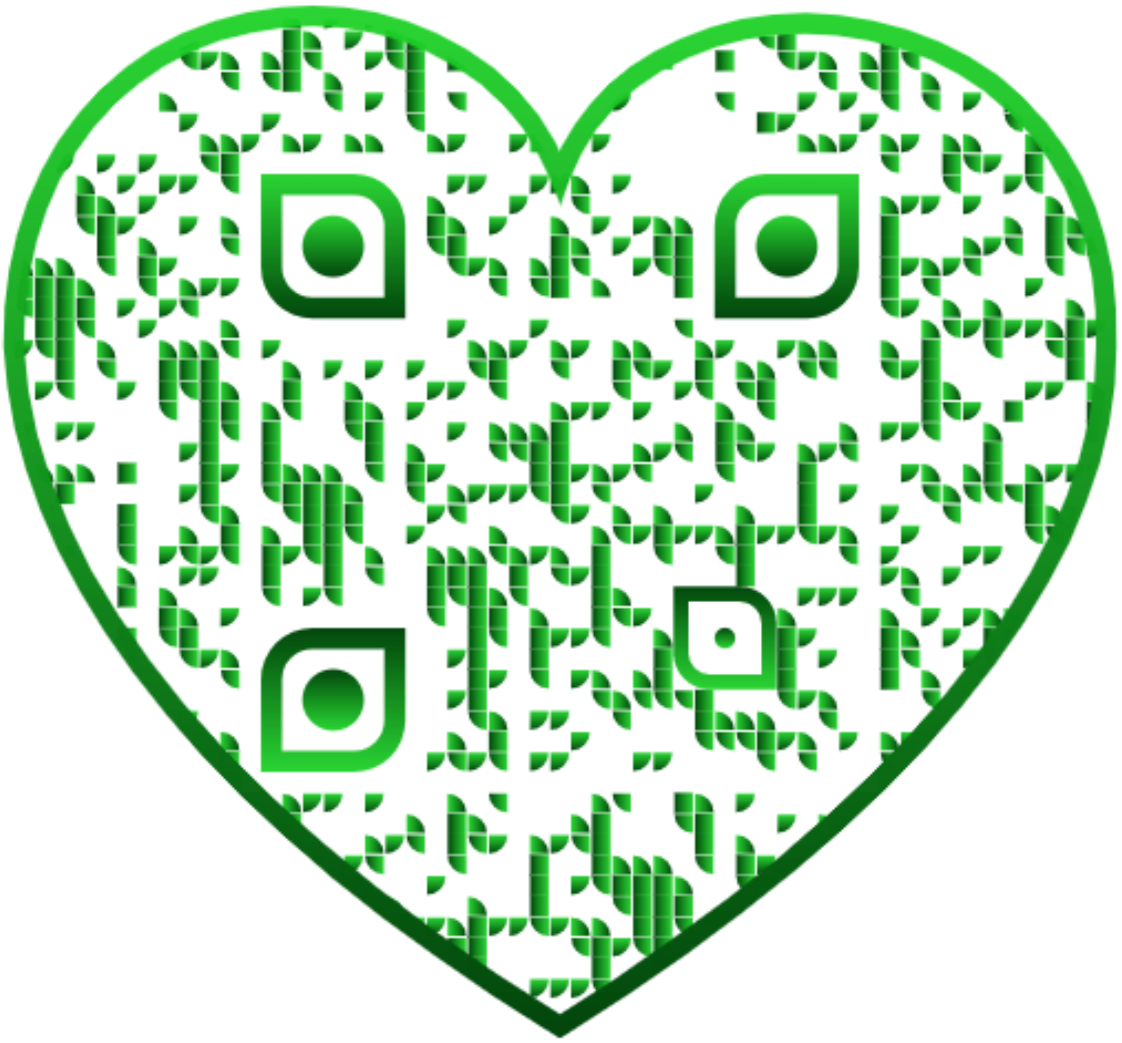
FORGOTTEN CIVILIZATION



THE ROLE OF SOLAR OUTBURSTS IN OUR PAST AND FUTURE

ROBERT M. SCHOCH, Ph.D.



FORGOTTEN CIVILIZATION

THE ROLE OF SOLAR OUTBURSTS IN OUR PAST AND FUTURE

Robert M. Schoch, Ph.D.

Inner Traditions
Rochester, Vermont • Toronto, Canada

FORGOTTEN CIVILIZATION

“Schoch is a true scientist, following the data wherever it leads, heedless of political pressures or worn-out paradigms. Twenty-two years ago, his redating of the Sphinx launched the New Archaeology. *Forgotten Civilization* distills all that has happened since into a simple conclusion: that solar activity ended the last cycle of high culture and may destroy ours in turn. Schoch is no scaremonger, no hawker of a pet theory. What we do with this knowledge is up to us, but once digested, it changes everything.”

JOSCELYN GODWIN, AUTHOR OF *ATLANTIS AND THE CYCLES OF TIME*

CONTENTS

Cover Image
Title Page
Dedication
Epigraph
Acknowledgments
Preface

Chapter 1: A Whirlwind Trip

Chapter 2: The Great Sphinx

THE SPHINX AND I
HISTORY OF AN ENIGMA
REDATING THE GREAT SPHINX
THE CHANGING FACE OF THE SPHINX
A SECRET CHAMBER?
SOME PERSONAL ANECDOTES CONCERNING THE SPHINX

Chapter 3: Göbekli Tepe and the Origins of Civilization

BETTER THAN POTTERY SHARDS
DEATH CULT CENTER OR THE TRUE GARDEN OF EDEN?
WHAT ELSE DID THE BUILDERS OF GÖBEKLI TEPE HAVE?
ANCIENT KNOWLEDGE PURPOSEFULLY BURIED?
A RECORD OF PRECESSION AT GÖBEKLI TEPE

Chapter 4: Defining Civilization

THE REVOLUTIONS OF PREHISTORY
THE ELEMENTS OF CIVILIZATION
CHALLENGING THE PARADIGM
THE FIRST ECONOMIC REVOLUTION
MODERN BIASES

Chapter 5: Te Pito Te Henua (The Navel of the World), Easter Island

THE CHRONOLOGY AND DATING OF THE MOAI
HOW WERE THE MOAI MOVED?
LEGENDS OF GIANTS
BIRDMEN PETROGLYPHS AND OTHER ANOMALIES

Chapter 6: The End of the Last Ice Age

THE YOUNGER DRYAS
THE FOURTH STATE OF MATTER
RECORDS ENGRAVED ON ROCKS
THE EASTER ISLAND CONNECTION
A PLASMA CATACLYSM

Chapter 7: Our Not-So-Eternal Sun

SUNSPOTS
EARTH’S MAGNETOSPHERE

A SOLAR PROTON EVENT AT THE END OF THE LAST ICE AGE

Chapter 8: Cosmoclimatology

PROTECTING THE PARADIGM
A NEW PARADIGM: COSMOCLIMATOLOGY

Chapter 9: Galactic Superwaves and Interstellar Dust Clouds

GALACTIC SUPERWAVES
GRAVITATIONAL WAVES AND EARTHQUAKES
ARE WE ENTERING A COSMIC INTERSTELLAR CLOUD?

Chapter 10: Ezekiel’s Vision

RONGORONGO
MORE BIBLICAL, ANCIENT, AND EVEN STONE AGE DEPICTIONS OF AURORAL DISPLAYS?

Chapter 11: Glass Castles, Fire from the Sky, and the Spoils of the Gods

VITRIFIED FORTS
HOW FAR BACK DOES VITRIFICATION GO?
THE HOW AND WHY BEHIND VITRIFICATION
FIRE FROM THE SKY
PLASMA IMPACTS

Chapter 12: The Carrington Event

RAMIFICATIONS OF A CARRINGTON-LEVEL EVENT (OR GREATER)

Chapter 13: The 2012 Date of the Maya

HALLS OF RECORDS: THE HAWARA LABYRINTH
HALLS OF RECORDS: THE CHAMBER UNDER THE SPHINX
HOW ACCURATE IS THE MAYAN CALENDAR?
2012 IN NEW ZEALAND AND ELSEWHERE

Chapter 14: Ancient Wisdom, New Discoveries, and New Science

BREAKING UP THE PARTY: THE NONCONSTANCY OF RADIOACTIVE DECAY
TEETH ON THE BELL CURVE: DISCREPANCIES IN BASIC NATURAL PROCESSES
FLUCTUATING FIELDS: CONSCIOUSNESS AND THE COSMOS
ELFS: TUNING INTO THE EARTH
THE POWER OF SOUND
THE POWER OF WATER
ENTANGLED DIAMONDS
THE FINE STRUCTURE OF THE UNIVERSE
A MATTER OF TIME
THE INFLUENCE OF THE FUTURE ON THE PAST
THE SCIENCE OF THE FUTURE
ZEP TEPI
OUR PAST AND OUR FUTURE: A FEW FINAL REMARKS

Appendix 1: Was the Great Sphinx Surrounded by a Moat?

ROBERT TEMPLE'S MOAT THEORY
SCRUTINIZING THE SPHINX
ANCIENT RAINS OR A MOAT?
GEOLOGICAL DETAILS
SUBSURFACE WEATHERING
SPHINX OR JACKAL? LION OR DOG?
THE GRANDEUR OF THE GREAT SPHINX

Appendix 2: Politics, Money, and Science

POLITICS AND SCIENCE
THREATENING THE PARADIGM

Appendix 3: A Note on the Naming and Dating of the End of the Last Ice Age

Appendix 4: Moving the Moai: Easter Island and Psychokinesis

GRAVITY AS AN ENTROPIC FORCE AND A THEORY OF PSYCHOKINESIS
EASTER ISLAND AND PSYCHOKINESIS

Appendix 5: Did a Comet Hit Earth at the Beginning of the Younger Dryas, circa 10,900 BCE?

A NOTE ON THE RECONSTRUCTION OF SOLAR ACTIVITY

THROUGH GEOLOGICAL TIME

Bibliography
About the Author
About Inner Traditions • Bear & Company
Books of Related Interest
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PREFACE

Forgotten Civilization. A few notes on the title, which was the brainchild of my wife, Katie, are in order.

To place things in context, when I was a youngster the British art historian Kenneth Clark (1903–1983) wrote and produced an influential thirteen-part television documentary series (first aired in 1969 by the British Broadcasting Corporation) and accompanying book, both of which were titled *Civilisation: A Personal View*. We were enthralled by the TV series and digested every word of the book, falling under the spell of this uncommon arbiter of taste and excellence, accepting his pronouncements without question. Clark codified for a generation the common concept of what civilization (being British, Clark spelled it as "civilisation") was all about, and his views endure among much of the public (or at least the Western European and American public) to this day. For his contributions, Clark received the title Lord Clark of Saltwood (Saltwood is a castle in Kent that Clark purchased in 1955).

In actuality, Clark had a rather narrow view of what exactly constituted civilization. His book and series concentrated on Western European Christian civilization from the period of about 1100 CE through the nineteenth century and had a decidedly English slant to it. About the concept of civilization more generally, leading up to the apparent height of civilization as he viewed it, Clark wrote:

There have been times in the history of man when the earth seems suddenly to have grown warmer or more radio-active. . . . I don't put that forward as a scientific proposition, but the fact remains that three or four times in history man has made a leap forward that would have been unthinkable under ordinary evolutionary conditions. One such time was about the year 3000 BC, when quite suddenly civilisation appeared, not only in Egypt and Mesopotamia but in the Indus valley; another was in the late sixth century BC, when there was not only the miracle of Ionia and Greece—philosophy, science, art, poetry, all reaching a point that wasn't reached again for 2000 years—but also in India a spiritual enlightenment that has perhaps never been equalled. Another was round about

the year 1100. It seems to have affected the whole world; but its strongest and most dramatic effect was in Western Europe—where it was most needed. It was like a Russian spring. In every branch of life—action, philosophy, organization, technology—there was an extraordinary outpouring of energy, an intensification of existence. (Clark 1969, 33; ellipses in the original)

My contention, as I will develop in this book, is that the sudden appearance of civilization circa 3000 BCE of which Clark speaks is not the first appearance of civilization. Rather it is the reemergence of civilization after some five thousand or more years. True, unambiguous civilization is evident during the period of circa 10,000 BCE to 9000 BCE, thousands of years earlier than the dynastic Egyptians and their contemporaries in Mesopotamia and the Indus Valley. This earliest flowering of civilization has been generally forgotten by humanity, although allusions to it are still to be found in sacred scriptures, traditional legends, and ancient texts; the Garden of Eden, tales of a golden age, and Plato’s recounting of Atlantis may all be referencing this primordial civilization. Now it is time to recognize its legacy.

. . . the Day of the Lord is going to come like a thief in the night. It is when people are saying, "How quiet and peaceful it is" that the worst suddenly happens, as suddenly as labour pains come on a pregnant woman; and there will be no way for anybody to evade it.

THE JERUSALEM BIBLE,
1 THESSALONIANS, 5:2–3

1

A WHIRLWIND TRIP

How could I say no? The Chilean ambassador to the United Arab Emirates, who befriended us when I spoke at the first International Conference on Ancient Studies in Dubai (UAE), November 29 and 30, 2008, had invited Katie (Catherine E. Ulissey, my fiancée at the time) and me to not only visit him and his family in Santiago, but to join him on a short expedition to Easter Island (which has been Chilean territory since its annexation in 1888). Honestly, I experienced some trepidation when initially considering the trip. On the one hand, this little speck of land is virtually synonymous with ancient mysteries, which for the last twenty years I had devoted much of my life to exploring around the globe, from Egypt to Peru to Japan. Easter Island was a definite on my list of "must see" destinations. On the other hand, it was a long way to travel for such a short excursion; the plan was to spend just seventy-three hours on the island. What could I accomplish in such a short period of time? But Katie convinced me we should take advantage of the opportunity. So, it was ago. In hindsight, those seventy-three hours on Easter Island changed my life in more than one way!

Something that attracted me personally to Easter Island was its remoteness, for here I reasoned might be preserved ancient traditions that elsewhere were lost or transformed by contact and conquest. Apparently isolated from the rest of the world for centuries or millennia—located in the South Pacific over two thousand kilometers from the nearest inhabited island—this tiny triangular piece of real estate (just 24.6 kilometers long and 12.3 kilometers at its widest point), was unknown to Westerners until the Dutch explorer Jacob Roggeveen spotted it on Easter Sunday 1722. Easter Island is the home of hundreds of gigantic stone heads and torsos, known as *moai,* that adorn the island. It is also the source of mysterious undeciphered glyphs inscribed on pieces of wood; known as the

rongorongo script, just over two dozen original tablets and objects (such as an inscribed wooden staff) have been preserved and are now scattered among museums around the world. So far undeciphered, although as I will discuss later in this book various gallant attempts have been made, they have been one of the great enigmas of linguistics. Might the moai and the rongorongo texts, I wondered, preserve some kind of legacy, some kind of message, from remote antiquity?

On the evening of December 28, 2009, Katie and I boarded a flight to Miami, and from Miami we flew to Santiago, Chile. Upon our arrival in Santiago the next morning, the ambassador and his wife met us at the airport. Initially we were to stay with them and their family, and indeed we visited extensively, but because other family members were also in town, we were graciously accommodated at a friend's house, even as they profusely apologized for the inconvenience to us. This turned out to be a most fortunate inconvenience, as the friend (who quickly became our friend too) was a native Easter Island (Rapanui) artist now living in Santiago, and furthermore his father (who just happened to be visiting him at the time and, unbeknownst to us, would travel with us to Easter Island) was a former governor of the island.

We spent several days dividing our time between hiking in the Andes Mountains on the outskirts of Santiago and absorbing Easter Island lore. Katie and I had already prepared ourselves over the preceding months by poring through and digesting all the books and literature about the island we could lay our hands on; we were determined to maximize our experience. Especially exciting to me was the collection of hundreds of old photos that our host shared with us, showing many of the moai and other ancient stone structures on the island before their modern restorations. Also included with the photos were numerous vignettes of life on the island in an earlier time. From a scientific point of view, such documentation is invaluable.

On New Year's Eve Katie and I participated in a fantastic costume ball hosted by the ambassador's mother (who joined the expedition to Easter Island, along with various other friends and family). New Year's Day was a time to relax and invigorate ourselves for the days to come. Early on the morning of Saturday, January 2, we headed for the Santiago airport to catch our flight. Traveling over five hours across the majestic Pacific, we touched down on Easter Island at about 1:00 p.m. local time.

The next three-plus days were wild, crazy, and wonderful. A magic carpet ride, as Katie likes to say. Reviewing in my mind or looking at the thousands of photos we shot, I am not sure how we fit so much in. We toured the island from end to end, using a small private bus under the guidance of another former governor, who also happened to be an extremely prominent Rapanui archaeologist. The moai and the *ahu* (platforms on which some of the moai were erected) were even more incredible and awe inspiring than I had imagined from simply reading about them and viewing photographs. I have learned over the years that there is never any substitute for seeing the real thing—a lesson continually reinforced on every trip I take, be it to a new area (as Easter Island was for me at the time) or old familiar territory (as parts of Egypt feel for me now after so many trips there). But it was not just the moai that struck me, for they are only part of the landscape, the seemingly primeval complex of Easter Island. There are also the quarries from which the moai were carved, the numerous petroglyphs (rock carvings, many representing strange "birdmen"), the low and thick stone buildings ("houses" found at the stone village and ceremonial center of Orongo on the southwestern tip of the island), the spherical stone known as the navel of the world, the natural caves found across this volcanic island, the ancient volcanic calderas themselves, and of course the inexplicable rongorongo script. In many ways it was too much to digest in three days, and so I simply took it all in, absorbing. I would try my best to make sense of it later.

Indeed, trying to make sense of the world is what drives me. I try not to readily accept simple pat answers uncritically. Studying so-called ancient mysteries, I have found that sometimes they are not quite so mysterious, as when data is misinterpreted (and, to put it bluntly, at times outright fraud is involved), while in other cases conventional and mainstream explanations serve to obscure and gloss over genuine mysteries. Actually, it seems to me, the latter is all too often the situation, as when those with vested interests feel they must preserve the status quo (we will explore this topic further in the pages that follow). In the case of Easter Island, it quickly became apparent to me that the standard archaeological explanations—that the island was first colonized by Polynesians about 1,500 years ago, who erected the moai, carved the petroglyphs, constructed the stone houses, and in the process brought ecological devastation to their tiny island such that it was a poor and impoverished people whom the Europeans encountered in 1722—were fundamentally flawed.

I am a trained geologist (Ph.D. in geology and geophysics from Yale University, 1983), and studying the varying levels of weathering and erosion and the degree of sediment built up around the moai (some that have been excavated were buried in up to six meters of sediment), I quickly became convinced that the standard story was improbable, to say the least. The high levels of sedimentation around certain moai suggested a much greater age than a mere 1,500 years. And what was the purpose of the low, thick, stone houses that oddly resemble modern bunkers or fallout shelters? Why did the indigenous people sometimes occupy the natural caves of the island? What about the stories of giants inhabiting the island in past times? And, perhaps most mysterious of all, what was the meaning of the rongorongo texts?

These are questions Katie and I pondered while we explored the island, but we had no ready answers (I further discuss all of these topics later in this book). One thing for certain, however, is that we did not find some of the conventional explanations very convincing. For instance, was the carving of the moai, perhaps ostensibly as part of an ancestor cult, really just "busy work" thought up by the chiefs and leaders as a way to keep the masses occupied and happy, so as to bond the elements of society together and avoid social turmoil? Was the rongorongo simply an indigenous eighteenth-century imitation of European writing? If this were indeed the case, then the rongorongo texts would be stripped of any antiquity, being a few centuries old at most, and would have little significance—a mere childish attempt by the "primitive" Easter Islanders to emulate the superior Westerners. What if, instead, the Easter Islanders were the guardians and keepers of ancient treasures? Conventional Western archaeologists, and their Western-trained Rapanui counterparts, are quick to dismiss such a notion (which, in my mind, elevates the status of the Rapanui) as mere fantasy.

Besides exploring the archaeological wonders of Easter Island, we also took in as much of the modern and traditional Rapanui ambiance as is possible in three days. I had the honor of meeting the current governor. We attended a "traditional" dance performance (honestly, I am not sure how traditional it was as much of the indigenous Easter Island culture was eradicated by European contact and has since been reconstructed based primarily on imported Polynesian models). We dined on the local food. We hired a small outboard motorboat and

cruised along the coast of the island. I even managed to make it briefly, after taking a dunk in the Pacific while trying to step from the boat as strong waves surged, to a little islet (tiny island) off the coast of the main island. I wanted to explore firsthand the pristine volcanic rocks and an ancient cave preserved on the islet.

On a very personal note, Katie and I were married on Easter Island—twice! During the afternoon of Monday, January 4, 2010, in the presence of an ambassador, two former governors, and a senior elder of the island, we were united during a civil ceremony at the appropriate Chilean government office on Easter Island. Then it was off to visit more moai and archaeological sites. That evening we were married again, this time in a traditional Rapanui ceremony presided over by the island elder who had attended our civil ceremony. We were lent traditional costumes adorned with feathers. Our skin and faces were decorated with paint, some made from the mud and minerals of the island, and we were crowned with feathered headdresses. I was allowed to borrow an antique bark-cloth cape, passed down through five generations, for the occasion. We were married barefoot, as we had always dreamed, in contact with the Earth, our Earth, and under the open sky, connecting with the cosmos. Not knowing the Rapanui language, we could not understand a word of the ceremony, but somehow the meaning came through. A feast in our honor followed the ceremony. It was a magical experience. We will be forever grateful for the hospitality and open hearts shown us. It was a unique honor to be the first couple married on Rapa Nui in the year 2010.

Tuesday morning, our last day on the island, we visited El Museo Antropológico Padre Sebastián Englert, where many fantastic, and I would add, somewhat inexplicable, artifacts from the island are housed, including a strange, alien-looking, small female moai carved of basalt. Then, our bags already packed, it was off to the airport to catch a 2:00 p.m. flight to Santiago. In Santiago we transferred to a flight bound for New York City, and from there caught our flight to Boston, Massachusetts, arriving home on the afternoon of January 6, 2010.

It was a dizzyingly exuberant trip; we were happy but exhausted. Flying back to the United States, there was no doubt in my mind that the trip had been worthwhile. Katie was right in urging we should go. But it was not until after we returned that I realized how worthwhile the trip really was. Not only had we

been married in one of the most exotic locations on Earth, with a genuine indigenous ceremony; not only had we explored enduring archaeological mysteries firsthand, but for me the seventy-three hours on Easter Island helped crystallize and reignite two decades of contemplating the dawn and demise of ancient civilization. It all came into perspective about two weeks after we returned from Easter Island, with a simple yet profound observation made by Katie.

One evening, my mind still racing from all I had seen on Easter Island—and perplexed at the genuine enigmas and disgusted by the conventional explanations (or should I say nonexplanations)—Katie suggested that we rewatch a video titled *Symbols of an Alien Sky* (Talbott 2009; see also Talbott and Thornhill 2005). One portion of the video discusses the work of Anthony L. Peratt, a plasma physicist associated with Los Alamos National Laboratory in New Mexico, who became interested in ancient petroglyphs (Peratt 2003). I already knew of Peratt's work and indeed had met him at a conference many years earlier. In a nutshell (we will review his work in more detail later in this book), Peratt noticed that many petroglyphs found around the world appear to record the shapes that would have been seen in the sky if there had been a major solar outburst—a plasma discharge (ionized particles and associated electrical and magnetic phenomena)—in ancient times. If our Sun discharged a huge ball of plasma toward us, it would have dire consequences for Earth, including life and humanity, as the surface of the planet would be literally fried by the incoming electrical currents. Nothing like this has been seen in modern times, although small plasma discharges, known as coronal mass ejections (CMEs), are a regular feature of the modern Sun. However, as a geologist, I was aware that going back in time the Sun has had periods of much higher activity, including at the end of the last ice age (circa 9700 BCE). Peratt and his colleagues postulated a major solar outburst in ancient times, but they did not specify a precise date or dates. They had also not considered one other very important thing.

Katie's simple but profound observation, while we watched the documentary, was that the rongorongo glyphs look remarkably similar to the petroglyphs that Peratt believes record plasma discharges and configurations, due to a major solar outburst, seen in the ancient skies. Could the rongorongo be a text, a scientific text if you will, that records in meticulous detail what was happening in the skies of long ago? Were the Easter Islanders in fact the keepers of an ancient, long

forgotten, knowledge?

I was struck, as if by plasma itself. Many isolated threads, topics I had pursued for years and decades, suddenly began to fall into place. My work on redating the Great Sphinx of Egypt (discussed in chapter 2) indicates that civilization and sophisticated culture date back thousands of years earlier than mainstream archaeologists have generally accepted. The same story seems to hold true for the oldest Easter Island moai, which may be thousands of years older than conventionally believed. And within months of visiting Easter Island, Katie and I found ourselves in Turkey inspecting the incredibly sophisticated and also incredibly ancient—dating back nearly twelve thousand years—site of Göbekli Tepe, confirming and reinforcing my work on the remote antiquity of early civilization. But the issue has always been, What could have happened to such an ancient, lost civilization? Why is there such a paucity of evidence for it?

Within weeks of our return, spurred by Katie's discovery, all that I had studied for so long came into sharp focus as the pieces began to fall into place, and a new story of a very ancient and long-forgotten civilization emerged. This is not another tale of lost continents and technologically advanced science-fiction-like beings loosely based on the overinterpretation of a few myths and legends. This is a story that combines the evidence of modern geology, geophysics, climatology, astrophysics, archaeology, comparative mythology, and many other disciplines. As we shall see, the catastrophes that occurred over ten thousand years ago, eradicating this early, forgotten civilization, appear to be on the verge of occurring once again. Furthermore, those very ancient peoples may have known something about the world and the cosmos that has since been lost. But if we can break free from the shackles and blinders of conventional status quo paradigms and worldviews, we may be able to regain this essential knowledge.

In this book we will explore these and related topics. Our story reaches back into the remote past and continues into the future. We need to understand multiple lines of evidence that together weave a new view of the origins of civilization, ancient history, our future, and the dynamics of the planet we live on. This is truly a grand puzzle with many parts. We will begin with a key piece, the Great Sphinx.

2

THE GREAT SPHINX

I have to admit that the Mena House (named in honor of Menes, the legendary first dynastic pharaoh of a united Egypt) is my favorite hotel in the Greater Cairo area. I love the nineteenth-century ambiance and the history. In a land where the history overwhelms you, this is a hotel that boasts a story of its own; it is a place where kings, princes, presidents, Hollywood royalty, and celebrities from all spheres have stayed. But, more than anything else about the Mena House, I love the view. Book the right room and you can have a private balcony overlooking the Great Pyramid, the only surviving wonder of the ancient world.

The Mena House is located in Giza (a city unto itself that forms part of modern Greater Cairo), just a half kilometer north of the Great Pyramid. Making your way out of the gated entrance, you can stroll the ever-bustling streets to the pyramids. But be prepared for the army of venders who will quickly descend on you, plying their ancient trade of hawking trinkets and fake antiquities. If you don’t feel like walking, there will be plenty of cabs for hire, as well as camels and horses.

Once situated far from any settlements, the Giza pyramids were built on the edge of the Sahara, the seemingly endless expanse of beautiful and forbidding dune-covered desert that stretches across the length of North Africa. Originally the Mena House was a royal lodge used by Isma’il Pasha (1830–1895), who reigned as the Ottoman *khedive* (viceroy) of Egypt and Sudan from 1863 to 1879. Here the khedive and his guests rested and refreshed themselves when off on a hunting expedition in the desert or paying a visit to the pyramids. Of course, today the pyramids still sit on the edge of the Sahara (the desert has not moved!), but roads crisscross and encircle the pyramids, which are quickly being walled in and surrounded by the ever-expanding modern neighborhoods necessitated by the burgeoning population of Greater Cairo.

The pyramids, and the Great Pyramid in particular, have justly earned their reputation as among the most amazing marvels of the ancient world. Perfectly aligned to the cardinal points (the Great Pyramid is oriented to true north with a tolerance that could not be matched again until the late nineteenth or early twentieth centuries) and built of multi-ton stone blocks with a precision that defies easy explanation, the pyramids remain an enigma on many levels. Modern engineers and common folk alike wonder how they were built. I myself have taken a great interest in the pyramids, even writing two books about them (Schoch with McNally 2003; Schoch and McNally 2005). However, my first love on the Giza Plateau is something else, something very nearby: the Great Sphinx.

THE SPHINX AND I

The Great Sphinx of Egypt, perhaps the most famous statue in the world, has a very personal meaning to me. The Sphinx and I have a long history together. For over twenty years the Sphinx has influenced and shaped my life, haunting me and speaking to me. I was first introduced to the problem of the age of the Sphinx in late 1989 by the "independent Egyptologist" John Anthony West, perhaps best known for his studies and popularization of the Egyptological work of the philosopher and mathematician R. A. Schwaller de Lubicz (1887–1961) and for his guidebook titled *The Traveler's Key to Ancient Egypt* (1985). Schwaller de Lubicz had suggested, in an almost offhand way, that the Great Sphinx was eroded by water, not wind and sand (see West 1993). West realized that if this were true, the implications would be profound. But who could confirm the nature of the weathering and erosion on the Sphinx? A geologist, of course! So West was on the lookout for an "open-minded" geologist who might critically and objectively take a look at the Great Sphinx.

A colleague of mine, an English professor who just happened to be teaching in the same college as I in the late 1980s, had met West while teaching in Cairo. He knew that West was looking for a geologist, so he arranged for West to give a lecture at the university and then invited me to join him and West for dinner. It only took one discussion and I was hooked.

The following summer West and I traveled to Egypt. I first met the Great

Sphinx face-to-face on June 17, 1990. Since then I have been back many times, more times than I remember, not only to study the Great Sphinx, but also to investigate other ancient mysteries in the land of the pharaohs as well.

It turned out that the issue of the weathering and erosion on the Sphinx was fairly simple and straightforward from a geological point of view. After only a couple of trips to Egypt, intensively studying the statue and its surroundings and collecting underground seismic data with geophysicist Thomas Dobecki (discussed in this chapter in the section "Redating the Great Sphinx," and see Dobecki and Schoch 1992), I felt confident enough to announce my results to the scientific community—and the world at large. At the October 1991 annual meeting of the Geological Society of America (GSA) I presented the evidence that the origin of the Great Sphinx must date back to at least the 7000 BCE to 5000 BCE range, or possibly earlier (this was allowed only after a formal abstract, submitted with West, was accepted based on a positive professional peer review; see Schoch and West 1991). I made my case using scientific analyses, comparing erosion and weathering profiles around the Sphinx to the ancient climatic history of Egypt. I was immediately bombarded by the media and lambasted by establishment archaeologists and Egyptologists. My life has never been the same since that fateful conference. A 1993 NBC documentary entitled *The Mystery of the Sphinx*, hosted by the late Charlton Heston and featuring me describing my research on-site in Egypt, was viewed by millions and received an Emmy Award (Sphinx Project 1993; the DVD version currently available has been re-edited from the original show and includes supplementary/extraneous material).

Many people know me, or believe they know me (or more accurately, know of me), due to the controversy over the age of the Sphinx that my research has engendered. I was even told by one writer and filmmaker that she knew my work better than I knew it myself! Be that as it may, here I will share my story of the Great Sphinx—and my work with her (to me the Sphinx has always been feminine), as I know it. First, a little background information on this icon of antiquity (for further information on the Great Sphinx, see my various papers and books listed in the bibliography).

HISTORY OF AN ENIGMA

Before we proceed further, it is important to understand the context of the Great Sphinx, in large part because conventional archaeologists heavily rely upon this context to date the Sphinx. Their reasoning essentially comes down to this: the Sphinx is surrounded by structures that date to about 2500 BCE, therefore it too must belong to this period. Of course, if you give it a little thought, this is not necessarily true. Think of Rome. Here is a city that traces its history, according to tradition, back to the year 753 BCE. It contains magnificent architectural wonders, statues, and monuments spanning over two thousand years. Imagine if archaeologists thousands of years from now found both the Coliseum (first century CE) and the remains of the National Monument of Victor Emmanuel II (early twentieth century). Would they blithely conclude, since these structures are relatively close to each other, that they both fit into the same context and therefore are of the same age?

Returning to Egypt, the Great Sphinx is located on the eastern edge of the Giza Plateau, also known as the Pyramids Plateau, on the west bank of the Nile across from Cairo. The Sphinx sits southeast of the Great Pyramid, attributed to the Fourth Dynasty pharaoh Khufu (Cheops, circa 2550 BCE), and due east of the second pyramid, the pyramid generally attributed to the pharaoh Khafre (Khafra, Chephren, Khephren), possibly the son or brother of Khufu. The second pyramid is just slightly smaller than the Great Pyramid. A third major pyramid, though considerably smaller than the other two, is also located on the Giza Plateau; it is attributed to the pharaoh Menkaura (Menkaure, Mycerinus), possibly a grandson or son of Khufu. Thus, according to standard Egyptological thinking, the Giza pyramids all date to around the period of 2500 BCE. According to the same Egyptologists, the Sphinx is clearly “associated” with the pyramids, so it must be about the same age. They do not consider the possibility that the Sphinx could be much older than the pyramids—that the site could have been used and reused, new structures being added in the vicinity of much older structures. Or, even more heretical, could the pyramids themselves be misdated? Here it is important to point out that it is the three Giza pyramids that various researchers, most notably Robert Bauval (Bauval and Gilbert 1994; see also Bauval and Brophy 2011), have correlated with the belt of the constellation Orion (representative of, in some guises, the Egyptian god Osiris). Furthermore, the precise correlation with Orion may not pertain to Egypt in 2500 BCE, but to a much earlier period—possibly going back to 10,000 BCE to 12,000 BCE (Bauval and Brophy 2011). This is not to say that the pyramids themselves are physically this old, but they may mark or memorialize a very old period in time.

This independent evidence of extreme antiquity on the Giza Plateau can only bolster my conclusion that the Sphinx is incredibly old.

The Great Sphinx is truly great in stature, being approximately twenty meters tall and over seventy meters long (the original length of the statue is difficult to determine because of the later repairs). It is carved out of solid bedrock limestone and faces due east. On the vernal and autumnal equinoxes the Sphinx is precisely aligned with the rising Sun. On these mornings the first rays of daylight strike directly on her face. Only the head sits above the ground level; to carve the body, the ancients had to cut down into the rock, and thus the Great Sphinx actually sits in what is known as the Sphinx Enclosure, or Sphinx Ditch. Immediately in front of the Sphinx, at a lower level (lower elevation), sits the Sphinx Temple. While carving out the core body of the Sphinx, huge multi-ton blocks were removed from the Sphinx Enclosure and assembled as the Sphinx Temple, so the original Sphinx Temple is as old as the core body of the Great Sphinx.

The traditional academics of the late twentieth century attributed the Great Sphinx to the pharaoh Khafre, builder of the second pyramid, circa 2500 BCE. In contrast, some classical Egyptologists of the nineteenth and early twentieth centuries dated the Great Sphinx to an earlier predynastic period, foreshadowing my own work. There are no definitive ancient records of who originally carved the Sphinx, or when, or why. We do not even know the name that the Old Kingdom Egyptians gave to the Sphinx.

A granite stela erected between the paws of the Sphinx by Thutmose IV, circa 1400 BCE, when excavated in the nineteenth century, was reported to include in its inscription the name, or at least part of the name, of Khafre (this portion of the inscription has since flaked away). This has been variously interpreted to indicate that either Khafre ordered the Sphinx carved or that Khafre ordered the Sphinx renovated, as Thutmose IV did over a millennium later. In reality, however, it is unclear if indeed it was the Fourth Dynasty pharaoh Khafre being named on the stela or what relationship the stela may have suggested that Khafre had to the Sphinx. The bottom line is, the Thutmose IV stela provides no definitive evidence of when, or by whom, the Sphinx was constructed. Also possibly bearing on the origins of the Great Sphinx is the so-called Inventory Stela, alternatively known as the Stela of Cheops’s (Khufu’s) Daughter.

Although the actual stela dates to the seventh or sixth century BCE, it purports to be a copy of an Old Kingdom text. According to the Inventory Stela, the Great Sphinx was already in existence during the reign of Khufu. Indeed, Khufu is credited with repairing the Sphinx after it was struck by lightning. Modern Egyptologists generally dismiss the Inventory Stela as a Late Period fabrication.

In New Kingdom times (circa 1550 BCE to 1070 BCE or so), the Great Sphinx was sometimes referred to as Horemakhet (Horemakhet, Harmakhet, Harmachis), which can be translated as "Horus of the Horizon" or "Horus in the Horizon," or as Ra-horakhty, translated as "Ra of the Two Horizons." In medieval Arabic times one appellation given to the Great Sphinx was Abu el-Hol (Abu al-Hol, Abou el Hôl), "Father of Terror(s)" or "The Terrifying One." The name Sphinx is derived from the Greek language and referred originally to the Greek sphinx. Sphinx may come from a Greek word meaning "to strangle," as according to one legend, the Greek sphinx, often depicted as a winged lion with the head of a woman, had the habit of strangling and devouring those who could not answer her riddles. Another interpretation is that the word *sphinx* was derived, possibly through Greeks visiting Egypt, from the ancient Egyptian *Shesep-ankh*, sometimes translated as "living statue" or "living image," a term used to refer to royal statues during the Old Kingdom.

REDATING THE GREAT SPHINX

I have studied extensively the nature and extent of the weathering and erosional features found on the statue directly, as well as the similar features found in the so-called Sphinx Enclosure (as already noted, the Sphinx sits in a hole or quarry, with its body below the level of the plateau behind it) and in the subsurface under and around the Sphinx. I have analyzed as well the numerous repairs to the Sphinx (some of which date back to Old Kingdom times). While my overall general conclusions have not changed since 1991, I have refined my thinking over the years.

Based on my geological analyses, I initially (and I now admit quite conservatively) calculated that the oldest portions of the Sphinx date back to the period of approximately 7000 BCE to 5000 BCE. I arrived at this conclusion through a variety of independent means, such as correlating the nature of the weathering with the climatic history of the area, calculating the amount of rock eroded away on the surface and estimating how long this may have taken, and

calibrating the depth of subsurface weathering around and below the Sphinx.

Key to my redating of the Sphinx is the interpretation that the weathering observed on the body of the Sphinx and the walls of the Sphinx Enclosure is not due to the arid desert conditions found in the region during the last four thousand to five thousand years. Rather, the observed weathering resulted from rain, precipitation, and water runoff, and sufficient precipitation was available only during pre-Sahara conditions, prior to circa 3000 BCE (Schoch 1992b, and references cited therein). Other geologists, such as Colin Reader and David Coxill (each working independently of me and also independently of each other; see Coxill 1998; and Reader 1997/1999) have corroborated my analyses of the nature of the weathering and erosion, concluding that the causative agent was water and not wind and sand (see Schoch 2002; Schoch with McNally 2003). I must note, however, that while Reader, Coxill, and I agree that the Sphinx was weathered by water and must date to an earlier period than the traditional attribution, we do not all agree on the same age estimate. In particular, Reader has argued that the Sphinx can still be accommodated into a very early dynastic time frame and thus is perhaps only a few hundred years older than the traditional date of circa 2500 BCE. However, I firmly believe that the extent of the erosion and weathering definitively push the core body of the Sphinx into a much more remote period. Furthermore, Reader does not take into adequate account the subsurface data that Dobecki and I collected (see discussion in this section, below), data that allow me to calibrate the rate of subsurface weathering and arrive at my age estimate for the Sphinx. My dating places the Sphinx well back into predynastic times, a period when many suppose that the technology and social organization did not exist to create such a monument.

Over the years various Egyptologists and archaeologists have suggested to me that yes, the Great Sphinx does show evidence of being weathered and eroded by rain, but this is because heavy rains in fact lasted well into the third millennium BCE. However, I believe this is incorrect, and there is clear evidence not far from Giza demonstrating just how early the hyperarid climatic conditions of the Sahara Desert set in. Mud-brick tombs called mastabas built on the Saqqara (Sakkara) Plateau, only about a dozen kilometers south of Giza and dated indisputably to circa 2800 BCE, show little if any rain weathering, even though they are built from a much softer and more vulnerable material than limestone and were subject to the same climatic conditions as the Great Sphinx.

Mud-brick mastabas would be quickly destroyed by much lighter rainfall than would be required to weather and erode the Sphinx. It simply is not possible that the Sphinx could have been carved after 2800 BCE, the date of the mastabas, yet weathered so badly under the scant rainfall (as indicated must be the case based on the survival of the mud-brick mastabas) that it required extensive repair by Old Kingdom times (the date of the earliest repairs to the Sphinx and Sphinx Temple). The archaeological evidence clearly disproves the assertion that there was enough rainfall around and after 2500 BCE to weather and erode the Sphinx to the state we observe on the statue.

Even though the Sphinx exhibits water erosion, this erosion was clearly from precipitation and rain runoff, not from flooding or the rising of the Nile. Also, the Sphinx was not eroded from standing water sitting in the Sphinx Enclosure (the idea that the Sphinx sat in a pool of water, or had a moat around it, does not stand up to geological scrutiny; see appendix 1). Another important point I should make is that fossil shells, sea urchins, and so forth can be found on the Giza Plateau, but these have nothing to do with the water erosion seen on the Sphinx. Rather, the fossil sea organisms are millions of years old and have weathered out of the limestone rocks from which the Sphinx, pyramids, and many other structures are built.

As I already mentioned, in the early 1990s I estimated that the oldest portions of the Great Sphinx date back to circa 5000 BCE or perhaps a bit earlier. (As I discuss later in this chapter, the head of the Sphinx is not the original head; it was clearly recarved in dynastic times.) Even as recently as 2007 I wrote, “Concerning my redating of the Sphinx, I emphasize that I am comfortable attributing it to the period of circa 5,000 B.C. or a bit earlier. Could it be considerably older? Based on the geological data, and depending on how one interprets the data, possibly. However, I have never claimed an age for the Great Sphinx prior to the 5,000 B.C. to 7,000 B.C. period” (Schoch 2007, 43).

Since then I have come to modify my opinion on the possible antiquity of the Great Sphinx in the light of more recent data. My initial “conservative” dating of the Great Sphinx to circa 5000 BCE was based on an extreme view of both the surface and subsurface seismic data, attempting to squeeze the data into as short a time frame as possible. Much of this has to do with the seismic data, measuring subsurface weathering, which we collected around the base of the Sphinx

(Dobecki and Schoch 1992). Subsurface weathering essentially consists of mineralogical and fabric changes of the rock that occur once the surface is exposed to the atmosphere; to the untrained eye, the rock may or may not look as if it is weathered. Over time, such weathering penetrates progressively farther (deeper) into the rock. This weathering can be detected using seismic wave velocity data.

The Sphinx itself faces east. The northern, southern, and eastern floors of the Sphinx Enclosure are weathered to a depth that varies between 1.8 and 2.5 meters below the surface. The western floor, however, is weathered less deeply, to a maximum of just 1.2 meters.

This difference is not due to variations in the rock; the exposed floor of the enclosure on all sides belongs to the same stratum of limestone. Rather, the western floor has been weathering for a shorter period of time. Obviously, it must have been excavated at a considerably later date.

There are two excavated walls at the western end of the Sphinx Enclosure—two tiers, if you will. The higher wall, which lies farther west, is deeply coved and fissured by rain and runoff. It must have been carved out when Egypt's climate was wet and rainy, well before the Old Kingdom. The second, lower wall, which is closer to the Sphinx's rump, shows much less precipitation weathering. It was along the base of this lower wall that the western seismic line, showing a depth of only 1.2 meters of weathering, was taken. The lower wall was excavated later than the higher wall, and certainly the western floor of the enclosure, where we took our seismic readings, was excavated later than the remainder of the enclosure—at a time when Egypt had already turned dry, during the Old Kingdom. Based on my analyses, I conclude that the Great Sphinx was carved and the Sphinx Temple was built well before the reign of Khafre, when heavy rain regularly washed across Egypt. Then Khafre claimed the site for himself, refurbishing the temple and Sphinx. Originally, I suspect, the sculpture's body emerged from the bedrock as if it were an integral part of the plateau. By carving the rump and digging out the western enclosure to a second, lower level, Khafre divided the monument from the rock and gave it its own separate aesthetic existence.

My analysis of the nature and depth of the subsurface weathering on the Giza

Plateau indicates that it has taken 4,500 years for the subsurface weathering at the younger, western floor of the Sphinx Enclosure to reach a depth of 1.2 meters. Since the weathering on the other three sides is between 50 and 100 percent deeper, as a first estimate I believed it was reasonable to assume that this excavation is 50 to 100 percent—or approximately 2,200 to 4,500 years—older than the western end. If we accept Khafre's reign, circa 2500 BCE, as the date for the western enclosure, then this calculation pushes the date for the Great Sphinx's original construction back to the 7000 to 4700 BCE range, or 6,700 to 9,000 years ago. Or, rounding, the origins of the Great Sphinx are pushed back to circa 7000 BCE to 5000 BCE.

However, there is the distinct possibility that this analysis underestimates the age of the Sphinx. Subsurface weathering rates often proceed nonlinearly; that is, the deeper the weathering goes, the slower it progresses because of protection from the overlying material. If we assume this is the case, then the estimated date above is only a bare minimum. The possibility of nonlinear weathering suggests that the very earliest portion of the Sphinx could date to before 7000 BCE, perhaps even as early as circa 10,000 BCE.

Sometimes people believe that my work confirms the age of the Sphinx as being on the order of 10,500 BCE, in line, for instance, with the prophecies of the late psychic Edgar Cayce (discussed in greater detail later in this chapter). This, however, is more a matter of opinion than fact. At this point I cannot unequivocally deny a 10,500 BCE date, but I still have reservations about such an early date for the Sphinx. However, Göbekli Tepe in Turkey (discussed in chapter 3) dates back to the end of the last ice age, circa 10,000 BCE to 9000 BCE, and at this point I find it tenable that the oldest portions of the Great Sphinx may date back to this remote period as well.

It has been suggested that the leonine aspect of the Sphinx connects it to the constellation Leo. In terms of zodiacal precessional ages, the transition from the Age of Virgo to the Age of Leo occurred around 10,500 BCE. Is it just coincidence that, based on the geology, the Great Sphinx, with a lion's body (originally the Sphinx may have had a lion's head as well) symbolizing Leo, dates back to a very remote period? Could the Sphinx be a representation of the Age of Leo, or even date to the Age of Leo, circa 10,500 BCE to 8500 or 8000 BCE (there is disagreement as to when this age begins and ends)? I have questioned this association, however, reasoning that it is not certain that the

constellation of Leo as such was recognized some twelve thousand or more years ago, and even if the Great Sphinx does represent or commemorate, in some aspect, the Age of Leo, that does not necessarily imply that it was sculpted during that age. However, in my opinion at this point, increasing evidence suggests that the Great Sphinx may actually date to the Age of Leo. I feel we must be open to the possibility. Even more widely speculative is the idea that the Great Sphinx was carved not in the last Age of Leo, but in the preceding Age of Leo, some thirty-six thousand or so years ago. Another widespread notion is to view the leonine-human hybrid aspect of the Sphinx as a representation of Leo and Virgo combined (the Age of Virgo is the age immediately preceding the Age of Leo)—the masculine and feminine, the animal or beastly vitality and the human intellect united. However, as I discuss below, the current human head of the Sphinx is not the original head. I favor the idea that originally the statue had a lion's head on a lion's body, which was connected with, and emerged from, the bedrock of the plateau at the western end of the Sphinx Enclosure.

Even as my redating of the Great Sphinx has been attacked as impossible by some authorities, other serious researchers have suggested that I have underestimated the true age of the oldest portions of the Great Sphinx, perhaps by tens of thousands of years or more. Recently I was reading *The Neanderthal Legacy* (2008) by the late Stan Gooch (1932–2010). In it he asserts that the head of the Sphinx was carved deliberately to include both Neanderthal and Cro-Magnon features. Could this indicate that the Sphinx is tens of thousands of years old? According to Gooch, ancient Neanderthals and Cro-Magnons met and interbred about thirty-five thousand years ago, giving rise to modern humans. The idea of such interbreeding is intriguing, but I am not convinced that the Sphinx contributes to the evidence for such a claim. In my opinion, the head of the Sphinx is not the original head; furthermore, black, African, or Nubian features are found on the current Sphinx head.

There are even more extreme interpretations as to the possible age of the Sphinx. Two members of the National Academy of Sciences of Ukraine, Vjacheslav I. Manichev and Alexander G. Parkhomenko (2008), citing my work, have reinterpreted the geological and erosional features on the Great Sphinx to mean that the core body of the statue could date back as far as eight hundred thousand years ago. And they are not referring to simply a natural outcropping that may have existed eight hundred thousand years ago that was later shaped

into a statue.

The dating of Manichev and Parkhomenko could push the age of the Great Sphinx into a very remote time period, one that has been suggested for possible, but ambiguous, ancient structures, sculptures, or simulacra that are found in many parts of the world, such as Markawasi in Peru (Schoch 2006/2007), the Romanian Sphinx (Welcome to Romania 2002), or a possible stone circle dubbed Adam's Calendar by researchers Johan Heine and Michael Tellinger, with a claimed date of from 75,000 years ago (Heine and Tellinger 2008; Serrao 2008) to 160,000 through 200,000 years ago (Eden 2009). Personally, I am not convinced that the Great Sphinx is anywhere close to the age postulated by Manichev and Parkhomenko or that various claims of very ancient, very eroded statues are anything more than natural formations, but the prospects are intriguing (Schoch 2006/2007). Without going off on such limbs, as we will discuss further later in this book (see chapter 3), there is clear evidence for an early high culture at a remote period beyond just that of the Great Sphinx.

While most of the focus of, and controversy surrounding, my work has been on the Great Sphinx, to my mind the so-called Sphinx Temple, sitting directly in front of (east of) the Sphinx, is in many ways even more significant than the Sphinx itself from a construction and dating point of view. The Sphinx Temple is built of megalithic limestone blocks, many weighing tens of tons, assembled in a tightly enclosed space. How these blocks were maneuvered is difficult to fathom. Pertinent to our current theme, however, is the fact that the Sphinx Temple (or at least the original parts of the temple, as it too, like the Sphinx, was reworked and repaired in dynastic times) was built contemporaneously with the oldest portions of the Great Sphinx. The blocks from which the temple was constructed were removed from around the body of the Sphinx as the statue was carved. The sculptors of the Sphinx did not simply chisel, pound, and shovel out the excess rock they needed to remove; rather, they meticulously quarried it as huge blocks used to construct the Sphinx Temple. Although it is in ruins today, I consider the building of the Sphinx Temple to be an engineering feat even more incredible than the carving of the Great Sphinx, and this occurred at the same time as when the original core body of the Sphinx was carved.

THE CHANGING FACE OF THE SPHINX

I must stress that in my assessment, the Great Sphinx of predynastic times did not look like the Sphinx we see today. It is only what I refer to as the core body (the torso or trunk) of the Sphinx that dates back to that much earlier period. The front paws have been heavily reworked and repaired (today they are mostly covered with modern blocks of limestone), and the head is surely not the original head. I have always contended that the head of the Great Sphinx is out of proportion relative to the size of the body. It is too small. In my opinion, the head was originally larger, but it was damaged by weathering and erosion, and to "repair" it the ancients recarved the head, resulting in its disproportionately small size today. Originally the head may not have been that of a human. Although I have no hard evidence, my speculation is that the head was originally that of a lion to fit the leonine body. As an aside, some years ago a noted Egyptologist refused to believe my observation that the current head of the Great Sphinx is too small for the body. He subsequently undertook an analysis of the proportions of many ancient Egyptian sphinxes, only to find that virtually all had similar head-to body ratios, except for the Great Sphinx, in which case the head was proportionally smaller.

In my opinion, based on analyses of the weathering and chisel marks as well as on stylistic considerations and the ethnicity of the head (clearly a "black African" or "Nubian" in my opinion), the current head of the Sphinx is a dynastic recarving, but probably older than the Fourth Dynasty. Some researchers have claimed that the current face of the Great Sphinx resembles the face found on statues of the pharaoh Khafre (builder of the second pyramid on the Giza Plateau) and have used this supposed evidence to support the attribution of the Sphinx to the period of Khafre, circa 2500 BCE. Personally, I never saw any similarity between Khafre and the Sphinx, but I am not formally trained in such analyses. In the early 1990s forensic expert Frank Domingo (formerly with the New York City Police Department) undertook a detailed comparison of the face of the Sphinx and the face of Khafre, concluding that they certainly do not represent the same individual and, indeed, that they do not appear to represent people of the same race or ethnicity.

In recent years some researchers have suggested that the face of the Sphinx represents that of Khufu (builder of the Great Pyramid) and that either the Great Sphinx was ordered built by Khufu himself or by his son Djedefre (Ra'djedef, who reigned for a short period between Khufu and Khafre), in the image of

Khufu. Personally, I am not convinced that the current face of the Sphinx represents Khufu, in part because Khufu and his family members, if they were related by blood (rather than by adoption) to Khafre, might be expected to share the same ethnic and racial characteristics with Khafre. Based on the beautifully preserved statues of Khafre (unfortunately, only one tiny ivory statuette of Khufu remains today, and its authenticity has been questioned), Khafre was clearly not of a strong black African or Nubian racial type, as is the current head of the Great Sphinx. However, it has been argued that Khufu himself had a more African face than Khafre (see Schoch and McNally 2005, 283).

I suspect the head of the Great Sphinx was recarved during the period of the First to Third dynasties (circa 2920 BCE–2575 BCE). Stylistically, to my eye, it might fit this early dynastic period. And the African or Nubian ethnicity of the Sphinx might fit an earlier period when the southern element of Egypt had greater sway than during certain later periods of Egyptian history. One must also remember that the head may have been further altered in later dynastic times. For instance, the entire Great Sphinx may have been modified, repaired, and brightly painted at various periods in its history, including during the New Kingdom. The current head as we view it today has been damaged, apparently both by weathering and by vandalism over the ages, and is possibly incomplete. It has been suggested that the Sphinx appears to be missing the uppermost part of its skull, the region of the crown chakra, or top of the head. Is this simply coincidental? Or was the crown purposefully removed for symbolic purposes? Also, to my eye the face of the Great Sphinx has always appeared to be either androgynous or female, and my personal intuition is that in fact it is a female face.

Admittedly, this is a subjective impression. Yes, parts of the Sphinx's "beard" (actually a ceremonial false beard) have been found and now reside in various museums, but that proves nothing. The beard was added much later and subsequently removed or lost again. At any rate, a beard on the Sphinx would be a symbol, such as of royal power and authority, and not indicative of the gender of the statue. I have seen more than one living African woman whose face strongly resembled that of the Great Sphinx. Furthermore, even if the current face of the Sphinx is feminine, this does not mean that the original Sphinx was female. If it was originally a lion, I believe it would have been most likely a male lion. Certainly if it represents, or was associated with, the constellation Leo

(which, astrologically speaking, is male and ruled by the Sun), the Sphinx was also originally a male.

A SECRET CHAMBER?

As part of our research on the Sphinx, geophysicist Thomas Dobecki and I undertook low-energy seismic studies around the Sphinx and elsewhere on the plateau. My primary concern with these studies was not to search for "buried treasure," but to gather good data on the nature, degree, and depth of subsurface weathering, both around the Sphinx and in areas containing confidently dated dynastic structures. Indeed, as discussed above, we acquired excellent data supporting my attribution of the Sphinx to 5000 BCE or earlier. However, we also discovered clear evidence of a cavity or chamber under the left paw of the Sphinx. This chamber measures approximately twelve meters in an east-west direction, approximately nine meters in a north-south direction, and measured from the current level of the floor of the Sphinx Enclosure, it lies under approximately five meters of rock. Additionally, we found some lesser (and previously known) cavities under and around the Sphinx, and the data also indicate that there may be a tunnel-like structure running the length of the body under the Sphinx.

A chamber in the vicinity of the paws of the Sphinx was certainly interesting to me, but I did not put that much emphasis on it. However, upon publication of our data (Dobecki and Schoch 1992), I soon found that a number of parties considered the chamber to be of extreme interest and importance. I still remember well the day, sitting in my office between teaching classes, that I received a phone call from the Virginia Beach headquarters of the Association for Research and Enlightenment (ARE, informally known as the Edgar Cayce Foundation). Unbeknownst to me, the American psychic Edgar Cayce (1877–1945) had predicted that a "Hall of Records" would be found in the general area where we had discovered the chamber. According to Cayce, the ancient continent of Atlantis had been destroyed circa 10,500 BCE. The survivors dispersed to the far corners of Earth, founding new offshoot civilizations, including one that in time would come to be recognized as ancient Egypt. In several locations (Bimini in the Bahamas, the Yucatan, and Egypt; see Association for Research and Enlightenment 2011), including in the region of

the Great Sphinx, they had secreted libraries recording their history, science, and accomplishments. Furthermore, the representative of the ARE informed me that my research on redating the Great Sphinx went a long way toward confirming the Cayce chronology of Atlantis and the building of structures on the Giza Plateau well before dynastic times. I found myself formally interviewed for the ARE's magazine, and I have spoken at their conferences in Virginia Beach. (To their credit, I would note that the ARE has a history of attracting top-notch researchers to speak at some of its conferences, researchers who in some cases are clearly antithetical to the main tenets and interests of the organiza tion. I have always found the leaders and members of the ARE to be warm, friendly, open, and honest.)

Delving into the details of the Cayce readings, I found one that appears to pertain to the Atlantean Hall of Records in the vicinity of the Sphinx:

A record of Atlantis from the beginnings of those periods when the Spirit took form or began the encasements in that land, and the developments of the peoples throughout their sojourn, with the record of the first destruction and the changes that took place in the land. . . .

This in position lies, as the sun rises from the waters, the line of the shadow (or light) falls between the paws of the Sphinx, that was later set as the sentinel or guard, and which may not be entered from the connecting chambers from the Sphinx's paw (right paw) until the TIME has been fulfilled when the changes must be active in this sphere of man's experience.

Between, then, the Sphinx and the river. (Reading 378–16 [Association for Research and Enlightenment 2011]; listed as reading "10/29/33 [apparently the date] 0378–016/11" by Mandeville, 1995–1999)

This prophecy is a bit confusing when trying to identify the actual location of the Hall of Records, but note that it mentions the "right paw" of the Sphinx. The chamber we found during our seismic studies is located below the left paw. Possibly the discrepancy can be explained this way: the Sphinx's left paw is the paw on the right side of a viewer standing face-to-face with the Sphinx.

It turns out that it is not only the members of the ARE who have a special interest in the discovery of chambers and tunnels under the Sphinx, but that members of many other groups do as well, such as various Rosicrucian and Freemason groups, who believe (with some good basis) that there is a complex

network of tunnels and chambers below the surface of the Giza Plateau.

Questions I am often asked include: Where is the entrance to the chamber under the left paw of the Sphinx? And have the Egyptian authorities allowed you to explore the chamber, and if not, why not?

In answer to the first question, I have not located any entrance to the chamber on the surface. However, based on the seismic data and analyses, we found that just in front of (just east of) the Sphinx Temple, buried under the sand, there is a substantial drop in the bedrock. That is, if the sand and debris were removed from in front of the Sphinx Temple, it would be found that the temple sits atop a cliff with the Great Sphinx itself looming over the temple. This must have been a very dramatic sight. I speculate that the entrance to the chamber under the paw of the Sphinx may be found in the cliff face.

To this date, the Egyptian authorities have not allowed me to explore the chamber that we found. Certainly, they are well aware that I would like to, and for the record, I have never been denied permission to do so outright; I have simply not been granted permission. I have some understanding of the complex intricacies and highly sensitive nature of exploring and excavating new archaeological finds in Egypt. I am not surprised that the authorities do not want to open more “cans of worms” at this time, and I am not an advocate of conspiracy theories. I am not aware of any credible evidence that the chamber has already been entered, as certain people have contended, but it is not impossible either. In recent years there has been growing concern over the rising water table, due in large part to the exploding population in the vicinity of the Great Sphinx. Under this pretext there has been drilling carried out by the Egyptian authorities around the Sphinx, including near the left paw. In a video posted on the Internet (Hawass and Lehner 2009), the Egyptian authorities are shown drilling directly under the left paw, and they assert that there is no evidence of a chamber. Viewing the video, it is clear to me that they missed the chamber! They were drilling at the wrong angle (too sharp) to intersect the chamber that we located seismically. Also in recent years, I have observed that the Egyptians have begun, ever so slowly, to excavate the area in front of the Sphinx Temple. If they persist in their endeavors, at some point they should uncover the cliff we discovered twenty years ago using geophysics, and I will not be surprised if a door or opening, leading to a passage under the Sphinx

Temple and thus into the chamber under the Sphinx, is eventually found. Something I have learned while working in Egypt is patience. However, I would appreciate the opportunity to assist in the endeavor and continue my research.

SOME PERSONAL ANECDOTES CONCERNING THE SPHINX

Even before I first met John Anthony West in 1989, I had given some thought to the Great Sphinx. As a teenager I loved ancient history, read profusely on the subject, and even acquired a few minor Egyptian antiquities from an aged fellow whose family had brought them out of Egypt when it was still legal to do so. But more directly applicable to my later research, I remember as a graduate student reading a couple of articles on the geology of the Great Sphinx.

In particular, a certain Egyptian researcher, now living and teaching in America, promulgated the notion that the Great Sphinx began as a *yardang;* that is, a natural hill or rock outcropping that had been weathered and shaped by the elements, primarily wind in the case of desert yardangs as found in Egypt. The ancient Egyptians, so his hypothesis went, saw in the yardang the crude shape of a sphinx (sort of like seeing the shapes of animals or people in clouds) and decided to start chiseling and carving the yardang to turn it into an actual sphinx. I recollect sitting in the geology department graduate student lounge at Yale University laughing over this crazy notion with my fellow geology graduate students. Remember, to free the body of the Sphinx from the bedrock, large blocks of limestone were quarried and removed. We thought it was hilarious that someone would think that wind could somehow carve out multi-ton blocks from around the body of the Sphinx and reassemble them as a temple in front of the statue.

Furthermore, the weathering features on the Sphinx (and mind you, we were basing this just on photos, as none of us had actually been to Egypt) did not appear to fit the yardang hypothesis. At most, perhaps the head of the Sphinx, which does sit above the level of the plateau, was once a yardang, but it has now been too heavily carved and recarved to tell for sure. We had our own theory: the author of the yardang hypothesis grew up in Egypt and as a small child visited the Great Sphinx. He was impressed by its size and majesty and also noted the heavy weathering to the statue, but did not at that time pay attention to the details of the geological and cultural context. Years later, without revisiting the

Sphinx to check the geology and location, he based his theory on those formative impressions from childhood.

Once I had traveled to Egypt to study the Great Sphinx firsthand, I reinvestigated the yardang hypothesis. As we had discussed in graduate school, it made absolutely no sense (except, perhaps, for the head), but there was one important aspect to it. The author of the yardang theory observed, and acknowledged, the very ancient weathering features still preserved on the body of the Sphinx. Indeed, one way to view the yardang theory is that it provides a way to explain how such incredibly ancient weathering can be found on a dynastic structure. According to the yardang theory, the weathering came first, followed by the carving of the Sphinx. But given the context, this is patently impossible. The body of the Sphinx and the walls of the Sphinx Enclosure were clearly weathered after being carved, and the weathering bears on the age of the Sphinx.

My work researching the Sphinx was done on my own time without remuneration, and the travel expenses to Egypt were funded by a group, spearheaded by West, intent on producing a documentary on the subject. The immediate result was *The Mystery of the Sphinx* (hosted by Charlton Heston, also known as “Moses”; Heston played the role of Moses in the famous Cecil B. DeMille movie *The Ten Commandments;* Sphinx Project 1993; DeMille 1956).

Not long after I became “notorious” for my work on the Sphinx, a senior faculty member at my college (College of General Studies, Boston University; I have taught there full-time since 1984), now deceased, told me that I had managed to immortalize myself by connecting my name to what is arguably the greatest and most recognizable sculpture on Earth. This was never my intention.

There are many personal anecdotes I can relate relative to my work with the Sphinx and the wide-ranging reaction to it. I will give a few here.

I first presented my analyses of the data on the Great Sphinx, coming to the conclusion that the core body dates well back to predynastic times, at the 1991 annual meeting of the GSA. Before the formal presentation I happened to run into a colleague of mine, a very talented geologist whose specialty was stratigraphy, the exact field that pertained to my data and analyses of the Great Sphinx. I showed him my data and explained my conclusions. His response: He

began to laugh. My heart sank to the pit of my stomach. I was sure I must have made some fundamental mistake to induce such laughter from him, and in the next hour I was scheduled to present my work in the public forum. I asked hesitantly what was wrong. He answered (a paraphrase after all these years), “Nothing, nothing at all. It is just so obvious. Hasn’t anyone ever looked at the Sphinx before? Where have all the Egyptologists been? Why didn’t they see this long ago?”

Some weeks after the 1991 GSA presentation, I heard from one of my former undergraduate professors, a man I had always respected, though had never known well. He was scathing in his comments regarding my work on the Sphinx, vehemently contending that I was quite wrong in recasting the age as anything other than circa 2500 BCE. But his arguments against me made no logical or scientific sense, as far as I could determine. Then it came out that he was a devout, and apparently somewhat fundamentalist, Christian (although by no means a creationist or a proponent of a young Earth), and basically he somehow viewed the implications of my redating of the Sphinx as questioning his religious faith (how, I am not exactly sure). Scientists are humans too, and their deep beliefs and long-held assumptions can certainly cloud their ability to think clearly.

Concerning the bitterness of infighting among academics, I learned my lesson well many years ago, at a Boston University faculty-staff Christmastime gathering. It was back in the early 1990s. During the holiday party a faculty member with the Archaeology Department accosted me concerning my work on the Great Sphinx. I had never met her before, though she had attacked me in the local press. Suddenly she appeared before me, face-to-face, as I was attempting to enjoy the hors d’oeuvres. She loudly spouted out a denunciation of my work and me, virtually spitting in my face, accused me of falsifying data and results, and called me a pseudoscientist. Then quickly, before I could respond, she disappeared back into the crowd. It was all quite disconcerting, and I even felt a bit threatened. Clearly, she had prepared her statement, ready to be delivered in a staccato voice if she happened to run into me. She did not want to open a dialogue on the subject. She did not care to learn about my evidence or analyses. I was the enemy as far as she was concerned, and that was that! I later learned that she and her colleagues in Archaeology were doing everything they could to make trouble for me behind the scenes, attempting to prevent me from any salary raises and spreading rumors in the Egyptian press (which I believe they thought I would never get wind of) that I was not a member of the Boston University

faculty, though I had already received tenure, as they knew. These are classic tactics attempting to marginalize someone who dares to challenge the dominant paradigm. The goal is to generally make life miserable for the dissenter with the hope that the challenge to the status quo will quietly disappear (for more on such issues generally, see appendix 2).

At one Egyptological conference to which I was invited to speak, I gave a nice, stolid presentation on the evidence for an older Sphinx. I did not get many comments from the audience, but afterward I was approached by a very senior, elderly, and rather grandfatherly Egyptologist. His comment to me, and I can only paraphrase it now as it was many years ago, was to the effect that "I do not understand geology, and I cannot refute your evidence, but I know you are wrong. Now there are lots of rocks other than at Giza and in Egypt; I suggest you go study the rocks somewhere else." By his demeanor and the tone of his voice, I took this as more than just a friendly suggestion. It was clear that he did not want me studying the Sphinx, and he was not beyond gently threatening me, implying that there could be untold consequences if I persisted in my endeavors along such lines.

At another conference, to which I was invited to debate the age of the Great Sphinx, prior to the public discussions I was sharing some of my data with a member of the "opposition." It was not that I was required to do so, but I shared my data of my own free will. I have never treated the controversy over the age of the Sphinx as a situation where I am determined to "win" and "prove" my hypothesis for an older Sphinx. Rather, my concern as a scientist and researcher is to gather the data, share the data, and honestly follow the data to wherever it should lead. Anyway, I was showing this professional "geoarchaeologist" some of the seismic data that we had collected around and under the Sphinx. He was having a difficult time interpreting it; looking down at the table, I saw a potential problem. Gently, and trying not to embarrass him, I said, "You might want to look at it this way," and I turned the charts around, as he had been trying to read them upside down. Even when viewing them in their correct orientation, he seemed not to be able to follow them. I quickly realized that despite his position at a major university and a Ph.D. in a relevant field, this man had absolutely no clue as to what he was looking at or how to interpret the data, and he was too proud to ask for help. The rest of the so-called debate was not very illuminating from my point of view. I attempted to present and discuss real data, while my

opponents at best skirted the issues and at worst lowered themselves to ad hominem attacks and insults against me personally.

At the same conference, I ran into one of my opponents, Mark Lehner, in a back hall; he has been hailed as one of the world's experts on the Great Sphinx, perhaps *the* world's expert (many years earlier he had been a follower of Edgar Cayce's teachings, even writing a book about them [Lehner 1974], but had since "seen the light" and become a conventional Egyptologist). We were alone and standing face-to-face, eye-to-eye. He said to me something like, "You can't really believe that the Sphinx is older than the Fourth Dynasty. You must know that is nonsense." Clearly, he was attempting to appeal to my academic, orthodox side. I almost felt like he was trying to "save" me from the unholy alternative theorists and the "New Age" camp, which he had once been so intimately associated with. He then asked me some question about my analyses of the Sphinx data. I honestly no longer remember the question, but I remember that the tone of his voice was rather bitter and sarcastic. I proceeded to answer in detail as he just stared at me with a blank look on his face, saying nothing. Then, as I was in midsentence, he simply turned around and walked away. I realized afterward that his "question" was meant as a rhetorical comment and that he had neither expected me to be able to answer it nor thought I would dare try to answer it. When I did answer him, he was caught off guard and apparently felt he had no other choice but to ignore me and walk away.

I have often felt that I am misunderstood when it comes to my work on the Sphinx. I am trained as a staid, traditional academic, with a Ph.D. from an Ivy League school (as mentioned, Ph.D. in geology and geophysics from Yale University, 1983) and a tenured teaching position. I think of myself as quite conventional, not as the radical alternative thinker that some have cast me. It is worth stressing that I believe in following the data to wherever they may lead, and my hypotheses and conclusions have not always gone over well with my traditional academic colleagues. In hindsight, I suppose I realize why I am thought of as a radical; it is not easy for people to accept that what they have always believed, what they may have staked their academic careers on, is not true after all. In my own way, I was threatening the established worldview.

I had pushed the Great Sphinx, arguably the grandest and most recognizable statue in the world, back into a period when humanity was supposedly just

transitioning from a hunter-gatherer economy to a sedentary life. People seven thousand or more years ago were still brutish and unsavory, at least by modern civilized norms, or so the standard story went. Certainly they were not carving giant statues out of solid limestone bedrock.

I have recounted some of my private experiences above, but I was really taken aback when my work became very public. Immediately after my announcement of an older Sphinx, I was under attack. Archaeologist Carol Redmount, of the University of California, Berkeley, was quoted in the media as saying, "There's just no way that could be true." The article continued, "'The people of that region would not have had the technology, the governing institutions or even the will to build such a structure thousands of years before Khafre's reign,' she said" (Dye 1991).

In other words, my new data did not fit with the establishment archaeological paradigm of what our ancestors were like at that remote period long ago. I was challenging Redmount's worldview, and she was fighting back. This would be a scenario that would repeat itself, with different players, over and over. Twenty years later, I almost feel like I am getting accustomed to it.

The initial hoopla peaked in February 1992 at a "debate" on the age of the Great Sphinx held at the Chicago meeting of the American Association for the Advancement of Science (Schoch 1992a). As the *New York Times* put it, "The exchange was to last an hour, but it spilled over to a news conference and then a hallway confrontation in which voices were raised and words skated on the icy edge of scientific politeness" (*New York Times* 1992).

Egyptologist Mark Lehner could not accept the notion of an older Sphinx, personally attacking me by labeling my research "pseudoscience." He argued, "If the Sphinx was built by an earlier culture, where is the evidence of that civilization? Where are the pottery shards? People during that age were hunters and gatherers. They didn't build cities" (*New York Times* 1992).

At the time I lacked any pottery shards. But I was sure of my science, and I persisted.

Two decades later, we have something far better than pottery shards, and dated to an even earlier period than my initial, conservative Sphinx date of circa

7000 BCE to 5000 BCE. These new discoveries, found in southeastern Turkey, will prove critical to ushering in a new model concerning the how, when, and why of early civilization. To understand the clash of paradigms, we need to look at both the old thinking and how the new evidence not only confirms my initial work on the Great Sphinx, but also changes our most basic assumptions about humanity ten thousand and more years ago.

3

GÖBEKLI TEPE AND THE ORIGINS OF CIVILIZATION

What were our ancestors like ten thousand or more years ago? The most common image is one of small nomadic bands endlessly in pursuit of the next meal. Men hunted game while women and children gathered fruits, seeds, roots, shoots, insects, and other edibles. The height of technology was a finely worked stone knife blade or spear point; nets, baskets, and cordage ostensibly were also put to good use. Permanent structures were superfluous, for these nomadic groups never stayed in one place very long. Material goods were sparse, as possessions had to be limited to those easily carried. Jewelry (perhaps beads, animal teeth, or shells strung on a cord) and personal decoration (body paint, tattoos) were prized. In colder climates appropriate clothing was fashioned from animal skins. Social institutions were minimal. Not until the Neolithic Revolution, beginning about ten thousand years ago, did agriculture and domestication appear, so we've been taught. This in turn allowed permanent settlement, leading to the specialization of labor, the development of crafts (including pottery and metalworking), the building of substantial structures, long-distance trade, and the slow and gradual evolution of complex societies.

None of this happened overnight, so the standard chronology goes. It took thousands of years, and it was not until around 4000 BCE to 3000 BCE that true signs of high culture first appeared, such as fine artistry in decorative crafts, written records, scientific observations of the heavens, complex political organizations, and megalithic building projects. This level of achievement was reached in Mesopotamia, the Nile Valley, and the Indus Valley by the beginning of the third millennium BCE. A well-known example is the rise of dynastic Egypt about 3200 BCE to 3100 BCE and the building of the Djoser (Zoser)

pyramid circa 2630 BCE. Stonehenge in England dates from the same period.

Although accepted as dogma by many, this nice neat scenario now appears to be completely wrong.

BETTER THAN POTTERY SHARDS

When I first publicized my redating of the Sphinx, I was challenged to name anything so old that was comparable to the Sphinx. Remember Egyptologist Mark Lehner's very public rebuttal to me back in 1992 asking me to produce some pottery shards?

I duly noted that very ancient and sophisticated remains have been found at such sites as Jericho (in Palestine, with a stone wall and tower dating back to circa 9000 BCE; Science Daily 2011a; Schoch with McNally 1999) and Çatalhüyük (also spelled Çatal Hüyük, Çatal Höyük, or Çatalhöyük, a Neolithic settlement in southern Anatolia, Turkey, circa 7500 BCE to 5700 BCE; Schoch with McNally 1999), but admittedly these examples do not include megalithic constructions comparable to the Great Sphinx. The Sphinx seemed to sit in splendid isolation, with no cultural context. What I would have given for not merely some pottery shards, but a good example of megalithic structures securely dated to ten thousand or twelve thousand years ago. Now we have it!

A short drive from Urfa (alternatively anlıurfa), in southeastern Turkey just north of the border with Syria, atop a mountain north of the Harran Plain, sits Göbekli Tepe (the name means "hill with a belly or navel"). Since 1995 Klaus Schmidt of the German Archaeological Institute has been excavating the site (Schmidt 2001, 2006/2008, 2007, 2010; Peters and Schmidt 2004; Birch 2008; Chandler 2009; Curry 2008a, 2008b; Mann 2011; Symmes, 2010). In May 2010 Katie, John Anthony West, and I visited it for ourselves. We were amazed.

Picture Stonehenge, multiply it by twenty, carve the pillars more ornately, place the circles next to one another, and intentionally bury them with a mountain of rock and dirt. This is Göbekli Tepe—so far! To date the small portion excavated has yielded dozens of carved limestone megaliths, many of which date back to the extraordinarily early period of eleven thousand to twelve thousand years ago. Immense, finely carved, and decorated T-shaped limestone pillars, many in the range of two to five and one-half meters tall and weighing up to an estimated ten to fifteen tons, form circles. An unfinished megalith, left

where it was being quarried, measures seven meters long. The workmanship is extraordinary, with clear, sharp edges that would do any modern mason proud. The major megaliths excavated thus far were originally erected in four distinct stone circles (labeled Enclosures A, B, C, and D by the archaeologists), ranging from ten to thirty meters in diameter (the primary inner circles with the largest pillars are ten to twenty meters in diameter, and the surrounding stone walls are up to thirty meters in diameter). Other stone megaliths have also been found. The hill of Göbekli Tepe covers some nine hectares (about twenty-two acres; Schmidt 2010), and based on geophysical surveys, the entire site may cover three dozen hectares (about ninety acres) and contain another sixteen to twenty stone circles (Global Heritage Fund 2011a, 2011b; Chandler 2009). This is an immense complex!

Göbekli Tepe boggles the imagination. The date is incredibly early, even earlier than my "conservative" estimate for the date of the Great Sphinx. Göbekli Tepe dates back to the end of the last ice age. It may be a cliché, but pondering Göbekli Tepe I cannot help but think of the opening scene of the classic 1968 movie *2001: A Space Odyssey*. In that film, a group of ape-like protohumans discovers a giant monolith; influenced by it, they learn to use tools, leading to civilization (Kubrick 1968).

Various pillars at Göbekli Tepe are decorated with bas-reliefs of animals, including foxes, boars, snakes, aurochs (wild cattle), Asiatic wild asses, wild sheep, birds (cranes, vultures, and ducks), a gazelle, and arthropods (a scorpion, ants, and/or spiders). The pillars may also carry symbols. In particular, the two central pillars of Enclosure D have arms, hands, belts, and loincloths, and on one of the belts are letter-like carvings (one resembles an "H," and others resemble a "U" turned sideways). Could the Göbekli Tepe people even have had a form of now-lost writing? The carvings are refined, sophisticated, and beautifully executed. Not only are there bas-reliefs, but also carvings in the round, including a carnivorous beast, possibly a lion or other feline, working its way down a column, apparently in pursuit of a boar carved in relief below. In-the-round carvings of lions and boars have been uncovered; these are now housed in the Museum of anlıurfa, as is a life-sized statue of a man (seemingly lacking a mouth), which, though from Urfa, apparently dates to the Göbekli Tepe era (this statue is generally known as Urfa Man; Batuman 2011, 76). Also from Göbekli Tepe are beautiful stone beads with incredibly small holes drilled through their

long axes, raising the issue of how this was accomplished with only "primitive" technology. And, according to Professor Schmidt, while some of the stone pillars were set directly into the local bedrock, others were set into a concrete-or terrazzo-like floor. Some of the pillars are very tall and thin, with what appear to be "weak" foundations. It has been speculated that this was purposeful, as originally the pillars may have been designed to hum in the wind, acoustically resonating like tuning forks (Batuman 2011, 74; see further discussion in the section on "The Power of Sound" in chapter 14). Looking only at style and quality of workmanship, one might easily suggest that Göbekli Tepe dates to between 3000 BCE and 1000 BCE. How wrong one would be. Based on radiocarbon analyses, the site goes back to the period of 10,000 BCE to 9000 BCE and was intentionally buried circa 8000 BCE. That is, the site dates back an astounding ten thousand to twelve thousand years ago!

I have to admit that even I, the person who geologically redated the oldest portion of the Great Sphinx to an incredibly early date, was initially skeptical about the dating of Göbekli Tepe, despite the fact that this is a discovery made by mainstream academics. I do not take just any claim on face value. For instance, the contention that gigantic pyramids, dating back ten thousand to twelve thousand years ago, have been found on the outskirts of the Bosnian town of Visoko is simply false—something I discovered only after visiting and examining the so-called pyramids firsthand (on the Bosnian pyramids, see Archaeological Park 2011; Bohannon 2006; Fronza Videoproducties 2011; Markey 2006; Parzinger *et al.* 2006; Schoch 2006; and Woodard 2009). Therefore it was important to me to both visit and examine Göbekli Tepe so as to fully understand the techniques and data used to determine the age of the complex located there.

I discussed the dating of Göbekli Tepe on-site with Professor Schmidt. It is based not only on calibrated radiocarbon dates of circa 9000 BCE or earlier taken on organic remains found in the material used to fill the site (these dates could be later than the actual occupation of the site), but also dates of circa 8000 BCE to 7500 BCE on pedogenic (formed with the soil) carbonate coatings and microstalactites on wall stones (see Peters and Schmidt 2004, 182). These carbonate coatings and microstalactites would have formed only after the burial of the site and after soil formation began, thus indicating that the site itself was buried by circa 8000 BCE (Batuman 2011, 72, cites a date of 8200 BCE for the

burial). Taken together, I am convinced that the evidence indicates that the site was actively used in the tenth and ninth millennia BCE and was intentionally buried (as indicated by the systematic layers of the fill material and the material the fill contains, including flint and obsidian tools and waste, and animal and plant remains) circa 8000 BCE. Why it was purposefully buried is a major mystery, one that we will return to. Arguably as much or more energy was expended burying the site as was used to originally carve and erect the stone pillars and walls.

The major, and older, stone circles (Enclosures A, B, C, and D) belong to Schmidt's Layer III. Overlying Layer III is the younger Layer II, which contains smaller pillars and structures and may date to the same period as the Neolithic site of Nevali Çori, an area northwest of Göbekli Tepe and similar in many respects to the Layer II period at Göbekli Tepe. Nevali Çori was excavated in the 1990s, but has since been flooded as a result of the Atatürk Dam built on the Euphrates River. Nevali Çori and Layer II of Göbekli Tepe may date to the second half of the ninth millennium BCE. In the catalog to accompany a 2007 exhibit at the Badisches Landesmuseum Karlsruhe, the earlier material at Göbekli Tepe, that of Layer III, is referred to as circa 9500 BCE to 8800 BCE, whereas the material from Layer II is referred to as circa 8800 to 8000 BCE, and material from Nevali Çori is dated as circa 8500 BCE to 7900 BCE.

What do we make of Göbekli Tepe? Ten thousand and more years ago was supposedly the time of brutish, nomadic hunters and gatherers who, according to many academics, did not have the technology, governing institutions, or will to build structures such as those found at Göbekli Tepe. Clearly there is a disconnect between what conventional historians and archaeologists have been teaching all these years and the clear evidence on the ground. Charles Mann wrote in *National Geographic*, "Discovering that hunter-gatherers had constructed Göbekli Tepe was like finding that someone had built a 747 [Boeing 747 commercial airliner] in a basement with an X-Acto knife [a small knife commonly used in model making]" (Mann 2011, 48; material in brackets here and in quotations throughout added by R. Schoch).

Stanford University archaeologist Ian Hodder commented that Göbekli Tepe is "unbelievably big and amazing, at a ridiculously early date . . . huge great stones and fantastic, highly refined art. . . . Many people think that it changes

everything. . . . It overturns the whole apple cart. All our theories were wrong" (Hodder, quoted in Symmes 2010).

Like my redating of the Great Sphinx, Göbekli Tepe forces us to reconsider our antiquity.

And as with my work on the Sphinx, the specialists are perplexed by Göbekli Tepe. Patrick Symmes wrote in *Newsweek*, "But the real reason the ruins at Göbekli remain almost unknown, not yet incorporated in textbooks, is that the evidence is too strong, not too weak. 'The problem with this discovery,' as [Glenn] Schwartz of Johns Hopkins puts it, 'is that it is unique.' No other monumental sites from the era have been found. Before Göbekli, humans drew stick figures on cave walls, shaped clay into tiny dolls, and perhaps piled up small stones for shelter or worship. Even after Göbekli, there is little evidence of sophisticated building" (Symmes 2010).

Indeed, the Göbekli Tepe people appear to have reached a high level of sophisticated culture, flourished for a relatively short period of time (even if some thousands of years), and then suddenly disappeared. As Klaus Schmidt has stated, "Even one thousand years later [after the purposeful burial of Göbekli Tepe and disappearance of the people], nothing is left of this world" (Schmidt, quoted in Batuman 2011, 80).

Göbekli Tepe poses a genuine mystery, one that I will attempt to unravel.

DEATH CULT CENTER OR THE TRUE GARDEN OF EDEN?

Göbekli Tepe—in its immensity—exists. Despite the challenges it presents for mainstream archaeologists, it demands an explanation. Exactly what was Göbekli Tepe? Why was it constructed at the cost of enormous time and energy?

Following the theories of Schmidt (discussed further below), in the popular media Göbekli Tepe has been hailed as the world's first temple (Curry 2008b; Mann 2011), the original Garden of Eden (Knox 2009; see also Batuman 2011, 81, and Curry 2008a, 278, both citing a 2006 cover story in *Der Spiegel*), and even an ancient version of Disneyland (Mann 2011).

Based on the known evidence, it has generally been asserted that the site was not permanently inhabited, that no living areas have been found. Archaeologist Ted Banning of the University of Toronto has proposed a different view (Banning 2011; Stacey 2011). Despite their elaborate decoration and sophisticated artwork, Banning suggests that the structures at Göbekli Tepe may in fact have been houses, not temples or other religious buildings. Specifically, he suggests, the Göbekli Tepe constructions may represent large communal houses. He writes that they are "similar in some ways to the large plank houses [of the native peoples] of the Northwest Coast of North America with their impressive house posts and totem poles. . . . It is . . . likely that some of these buildings [at Göbekli Tepe] were the locus for a variety of rituals, probably including feasts, mortuary rites, magic, and initiations, . . . there is generally no reason to presume a priori, even when these are as impressive as the buildings at Göbekli Tepe, that they were not also people's houses" (Banning, quoted in Stacey 2011). Indeed, in October 2010 a stone sculpture resembling a totem pole was found at Göbekli Tepe (Schmidt 2010, 248).

The numerous animal bones found at Göbekli Tepe suggest feasting and/or animal sacrifices. It has been suggested that stone basins uncovered by Schmidt may have been used for alcoholic beverages, such as beer (Mann 2011, 57). Perhaps this was a meeting place, a site where different clans and tribes gathered to celebrate. Did each of the approximately two-dozen stone circles belong to a different group? Some suggest that the T-shaped pillars represent stylized human figures.

The general consensus—not to say it is correct—is that Göbekli Tepe was a religious site, a very ancient temple, a holy and sacred spot, a series of shrines, a pilgrimage site. Recent studies of obsidian tools found at Göbekli Tepe reinforce the notion of this being a cosmopolitan gathering place. Several different sources for the obsidian have been identified, from as much as five hundred kilometers away. The style of some of the stone tools found at Göbekli Tepe suggests that people traveled to the site from as far as modern Iraq, Iran, along the middle portion of the Euphrates River, and various parts of the eastern Mediterranean (Jarus 2012).

When I look at the carvings of animals, I think of shamans with their animal totems and guides (here I use *shaman* in the general colloquial sense, not the

strict sense of Shirokogoroff 1935). Images of birds are found at Göbekli Tepe, traditional symbols of the spirit or soul. Vultures in particular may represent birds that carried away the dead. On one of the pillars at Göbekli Tepe there is a vulture with a round object on its wing, and toward the bottom of the same pillar is a bas-relief of a headless man with a prominent erect penis. Could this somehow represent a mythos of life, death, and rebirth? Schmidt suggests that this scene might illustrate an ancient myth of vultures carrying away the heads of dead people (Batuman 2011, 80). Or might it be an early representation of the concept of a bird carrying the Sun across the sky (Batuman 2011, 78)? Human bones found in association with Göbekli Tepe have been viewed as indications of a death cult (Vey 2011). Some of the human bones appear to have been unburied, perhaps left to be scavenged by wild animals, as was done in various later cultures (Tibet is an example; see David-Neel 1932). Could they even represent human sacrifices? Or was this a site of ancestor worship? In this connection, Brian Haughton writes, “Intriguingly, in recent excavations at Göbekli Tepe Schmidt’s team have uncovered pieces of human bones in soils which came from the niches behind the stone pillars at the site. Schmidt believes the bones show that corpses were brought into the ritual areas demarcated by the engraved T-shaped stone[s], where they were then laid out and left to be stripped of their soft tissue by wild animals. Such activity would [suggest that] Göbekli Tepe [was] both a cemetery and a center of a regional death cult” (Haughton 2011).

Honestly, I find such speculations interesting, but until we have more evidence, they can only remain speculations. Certainly there are other reasons that such human bone fragments might be found. There could have been a random death, a murder, or perhaps people died of natural catastrophes. Subsequently wild animals scavenged the bodies because there was no one to attend to their immediate burial. Only later, perhaps, did survivors of the catastrophe return to collect and bury any remains that could be found.

Göbekli Tepe has been hailed in some circles as figuratively, if not literally, the biblical Garden of Eden as described in the book of Genesis.

Yahweh God planted a garden in Eden which is in the east, and there he put the man he had fashioned.

Yahweh God caused to spring up from the soil every kind of tree, enticing to look at and good to eat, with the tree of life and the tree of the knowledge of good and evil in the middle of the garden.

A river flowed from Eden to water the garden, and from there it divided to make four streams.

The first is named the Pishon, and this encircles the whole land of Havilah where there is gold.

The gold of this land is pure; bdellium and onyx stone are found there.

The second river is named the Gihon, and this encircles the whole land of Cush.

The third river is named the Tigris, and this flows to the east of Ashur. The fourth river is the Euphrates.

Yahweh God took the man and settled him in the garden of Eden to cultivate and take care of it.

Then Yahweh God gave the man this admonition, “You may eat indeed of all the trees in the garden.

Nevertheless of the tree of the knowledge of good and evil you are not to eat, for on the day you eat of it you shall most surely die.” (Jerusalem Bible, 1968, Genesis 2:8–17)

Like the fabled Eden, Göbekli Tepe lies between the northern portions of the Tigris and Euphrates Rivers. Although it is a bleak, barren desert landscape now, twelve thousand years ago Göbekli Tepe was an area of abundant plant and animal life, a hunter-gatherer’s paradise. Göbekli Tepe is also an area where early domestication and agriculture took place, more or less contemporaneously with the use of the structures, over several thousand years. The traditional view is that erecting a complex on the order of Göbekli Tepe would have required a sedentary, organized, labor force, and this would only be possible after domestication and agriculture were well established. But perhaps it was the other way around. Did the gathering of large numbers of people at Göbekli Tepe cause

depletion of the local natural resources and essentially force the development of agriculture? Early farming may have been disadvantageous compared to gathering and hunting in a paradise. Farming was time-consuming, backbreaking labor that yielded relatively poor nutrition. As God said to Adam, after he ate the forbidden fruit that the serpent convinced Eve to taste, “Accursed be the soil because of you. With suffering shall you get your food from it every day of your life” (Jerusalem Bible, 1968, Genesis 3:17). And there are snakes and serpents, carved on some of the pillars of Göbekli Tepe.

WHAT ELSE DID THE BUILDERS OF GÖBEKLI TEPE HAVE?

On the face of it, the carved pillars that have been thus far excavated at Göbekli Tepe indicate that their makers must have had an incredibly sophisticated material and social culture. Furthermore, remember that at this point only a small proportion of the site has been excavated. At least another sixteen to twenty stone enclosures are still under the ground, and there may be many more structures and artifacts buried in the surrounding hills and mountains. We do not know if the excavated areas of Göbekli Tepe are even representative of the whole, or if entirely different carvings, symbols, and types of structures will be found. In my opinion, it is premature to attempt to definitively “decode” or interpret the meaning and functions of the Göbekli Tepe carvings and structures. As I have already pointed out, some of the excavated pillars of Göbekli Tepe carry what may well be abstract symbols, even glimmerings of writing. I will not be overly surprised if further excavations uncover more symbols or even what might be effectively a form of written language.

Göbekli Tepe is readily compared to Stonehenge in England, arguably one of the most famous archaeological sites in the world along with the Great Sphinx and Pyramids. But Stonehenge and the hundreds of other stone circles and related structures found throughout Europe and the British Isles (see, for instance, Burl 1976) are downright crude compared to Göbekli Tepe, yet these British and European stone megaliths are conventionally dated about five thousand to seven thousand or more years later than Göbekli Tepe! (This, of course, is assuming that the dates conventionally assigned to these structures are correct. Many of the dates are based on radiocarbon analysis of organic materials found in association with the stone circles, but it could well be that the stone

circles are much older than the organic remains, being used and reused for many generations, indeed many millennia.)

What other material artifacts might the Göbekli Tepe people have had? It is difficult to know, especially since the majority of organic-based materials are extremely perishable and would not last for over ten thousand years. Certainly, I believe the Göbekli Tepe people had various implements of wood, leather, fur, and fiber. In particular, they surely would have had ropes, baskets, cords, nets, textiles, and other fiber-based artifacts. Beautifully woven textiles dating back to twelve thousand years ago—the end of the last ice age and Göbekli Tepe times—have been found in Peru (*Past Horizons* 2011; Maestri 2011). In addition to various stone beads, button-like artifacts carved from stone that could have been used with clothing are found at Göbekli Tepe (Badisches Landesmuseum Karlsruhe 2007a). In fact, evidence for full-fledged textiles, in the form of clay impressions of woven materials, date back twenty-five thousand years, and in a cave in the country of Georgia (north of eastern Turkey and the site of Göbekli Tepe) human-processed flax fibers (which traditionally are used to make linen) have been found that date back thirty thousand years or more (Harris 2009). No actual objects made from the fibers were found, as they may have degraded away or perhaps the fibers were only leftovers from mending or manufacturing objects. Archaeologist Ofer Bar-Yosef, of Harvard University, suggests the fibers were braided together to "make headgear, you can make baskets, you can make ropes and strings, and so on" (Bar-Yosef, quoted in Harris 2009). In my opinion, it is quite conceivable that they were making actual textiles that could have been used for clothing, to make bags, tents, and any number of other items. Interestingly, and tellingly, the thirty-thousand-year-old fibers from Georgia were purposefully dyed various shades of black, gray, pink, and turquoise. Clearly these ancient people had a sense of color and aesthetics.

Even in terms of stone or other nonperishable artifacts, it is naïve to assume that we have more than a vague inkling as to what the Göbekli Tepe people possessed. It is not as if they would casually leave their precious objects lying about willy-nilly for us to find over ten thousand years later (granted they may have stored or buried, perhaps in a grave setting, certain objects, but then it is a matter of us locating them). Certainly, based on such items as the stone beads and stone button-like objects found at Göbekli Tepe, it appears they had a fine aesthetic sense in terms of jewelry and personal ornamentation.

Other evidence from Turkey, suggestive of the material culture of the Göbekli Tepe people, further reinforces the contention that the level of technological and cultural sophistication in the region ten thousand or so years ago has been greatly underestimated. Recently a fragment of an obsidian (volcanic glass) bracelet dated to 7500 BCE (just after Göbekli Tepe times) from the Neolithic site of A ıklı Höyük in central Anatolia, Turkey, has been analyzed using modern high-tech methods (Thornhill 2011). The bracelet is described as having "a complex shape and a remarkable central annular ridge, and is 10 cm in diameter and 3.3 cm wide" (Physorg.com 2011a). Modern laboratory studies "revealed that the bracelet was made using highly specialized manufacturing techniques. The analyses carried out showed that the bracelet was almost perfectly regular. The symmetry of the central annular ridge is extremely precise, to the nearest degree and nearest hundred micrometers. This suggests that the artisans of the time used models to control its shape when it was being made. The surface finish of the bracelet (which is very regular, resembling a mirror) required the use of complex polishing techniques capable of obtaining a nanometer-scale surface quality worthy of today's telescope lenses" (Physorg.com 2011a).

Besides their material culture, the Göbekli Tepe people surely had a rich oral and nonmaterial tradition that included mythology, history, religion, music, dance, and knowledge of the natural world, from the seasons and calendrical calculations and astronomy to the way to use plants, animals, herbs, and medicines. But I wonder if such knowledge was entirely oral and committed to memory, to be passed down from generation to generation. I do not think it inconceivable that the Göbekli Tepe people had some form of paper (be it paper as we think of it today or more a cloth or parchment substance) on which they made notations or even had what could be classified as actual writing. If there is one thing that we should learn from the modern history of archaeology, it is that we have consistently underestimated the level of sophistication, and antiquity, of our forebears.

ANCIENT KNOWLEDGE PURPOSEFULLY BURIED?

When I consider Göbekli Tepe, the first thing that comes to mind is that this was a center of knowledge, which of course is not incompatible with a religious site.

Could the positions of the monoliths and the specific carvings on their surfaces encode information? Obvious suggestions are that the various stone circles were calendrical or astronomical. Might constellations be depicted or encoded in the carved reliefs or positions of the megaliths? Are there significant alignments among the stones? Did each circle refer to a different topic or branch of ancient knowledge?

Göbekli Tepe was built, used, and added to for a couple of thousand years. My interpretation is that there were three main phases. First, the beautiful T-shaped stone pillars were erected and carved. Typically about a dozen such pillars were erected in a circle or oval, and two more stood in the center. Based on the roughened top surfaces that they bear, the pillars may also have supported some kind of roof or superstructure at some point in their history. Second, relatively crude stone walls were built between the outer pillars, forming circular enclosures. These walls abut, and in some cases appear to cover or hide, the carved reliefs on the pillars. It is also apparent that some of the T-shaped pillars had toppled over and were reerected when the secondary stone walls were built. I sense that the site was being converted into some kind of defensive structure. Finally, about ten thousand years ago, the entire complex was intentionally buried under tons of rock and earth.

There is no doubt Göbekli Tepe was used and reused for a long time, by my estimate at least two thousand years, before being intentionally buried around 8000 BCE. Even long after its burial, Göbekli Tepe may have retained its importance for local peoples. Professor Schmidt suggested that some of the carved depressions and gouges, for instance on the tops of pillars, may date to a time when the site was buried but still remembered as an important or holy site, and people still came to partake of the energy of the site. As Veysí Yildiz, son of the local landowner, explained, even before the archaeological remains were discovered at Göbekli Tepe, the area was held in reverence (stonecovered graves are found on the top of the mound to this day).

Why the different uses of the site? Why the eventual abandonment and burial? Had the temple, the sacred ground, come to the end of its life cycle? Was it ritually desanctified, decommissioned? Or did the people of Göbekli Tepe turn from hunting and gathering to agriculture, and in the process abandon their old ways, their old gods? Or did the people suffer natural catastrophes? Twelve thousand to ten thousand years ago the last glacial period came to an end, sea

levels were rising, climates were fluctuating, and some believe the poles were shifting and comets were bombarding our planet, and as we shall see, there is strong evidence of a major solar outburst at this time. In the wake of calamity, did the people of Göbekli Tepe first attempt to fortify their structures and then realizing that it was futile, bury them and flee? Did they hope to return again to uncover their monuments?

In a nutshell, we have evidence of high culture and civilization circa 10,000 BCE to 8000 BCE, but then an apparent decline or hiatus for thousands of years, until the "rise" of civilization once again in Mesopotamia, Egypt, and elsewhere. What happened?

A RECORD OF PRECESSION AT GÖBEKLI TEPE

A hallmark of civilization is precise scientific observation. Astronomy is often considered the earliest yet most sophisticated of the sciences. A particularly subtle astronomical phenomenon, the discovery of which is generally credited to Hipparchus of Rhodes in the second century BCE (Magli 2004, 2009), is the slow movement of the stars relative to the equatorial coordinate system. This is commonly referred to as the precession of the equinoxes. The entire cycle, with stars returning to their "starting points," takes somewhat under twenty-six thousand years. Some researchers suggest that precession was known to the ancient Egyptians and other early civilizations and is reflected in myths worldwide (Lockyer 1894; de Santillana and von Dechend 1969). Others dispute such assertions. I found evidence of precession at Göbekli Tepe, adding another layer of sophistication to this remarkable site.

The excavated portions (as of 2010–2011) of Göbekli Tepe lie on the southern slope of a hill looking out to the southern skies. Thus far, the better part of four stone circles (enclosures) has been excavated in an area measuring about forty-by-forty meters. Additional younger and smaller pillars and structures have been partially uncovered, both twenty to thirty meters north and about eighty meters west of the major area of circles (the main, and older, portion of Göbekli Tepe under discussion here belongs to Schmidt's Layer III; the younger and smaller pillars and structures belong to Schmidt's Layer II), and approximately eighteen or more stone circles still under the earth have been identified. Enclosure D is located furthest north. To the southeast lies Enclosure C, and to

the south of Enclosure D lie Enclosure B and finally A. The enclosures are very close to each other, almost abutting. Each enclosure possesses a pair of tall central pillars erected parallel to each other and ringed by a circle of shorter pillars with later stone walls between the pillars. If at some point the enclosures were covered over, they may have been entered from above; indeed, possible carved stone "portals" have been found that may have been set in a roof.

The central pairs of pillars are oriented generally toward the southeast, as if forming sighting tubes toward the sky. Remarkably, the central pillars of Enclosure D include arms and hands, with the hands holding the belly or navel area, and it is clear that the anthropomorphic pillars are facing south. The Enclosure D central pillars are also wearing belts and loincloths (to my eye, the loincloths appear to be formed from fox pelts); overall, I have the impression that the pillars represent headless hunters. The orientations of the central pillars vary from enclosure to enclosure, however. For Enclosure D the central pillars are oriented approximately 7° east of south. Those for Enclosures C, B, and A are approximately 13° east of south, 20° east of south, and 35° east of south, respectively (these measurements are only approximate and are based on the plan of Göbekli Tepe published by Peters and Schmidt 2004, 186). These varying angles suggest the builders were observing stars and building new enclosures oriented progressively toward the east as they followed particular stars or star clusters over hundreds of years.

What were the builders observing? This is a difficult question to answer, but we can hypothesize. On the morning of the vernal equinox of circa 10,000 BCE, before the Sun rose due east at Göbekli Tepe, the Pleiades, Taurus, and the top of Orion were in view in the direction indicated by the central stones of Enclosure D (as noted above, these pillars face south; this is indicated by the positions of the hands and loincloths), with Orion's Belt not far above the horizon as dawn broke (as seen from the best vantage points in the area). (Alignments discussed in this section on Göbekli Tepe were determined using the 2003 version of the Starry Night Pro 4.5 computer program by Space Holding Company, Toronto.)

A similar scenario played out for the orientation of the central stones of Enclosure C in circa 9500 BCE and for Enclosure B in circa 9000 BCE. Enclosure A is oriented toward the Pleiades, Taurus, and Orion on the morning of the Vernal Equinox circa 8500 BCE, but due to precessional changes, the

entire belt of Orion no longer rose above the horizon before dawn broke. By about 8150 BCE the belt of Orion remained below the horizon at dawn on the morning of the vernal equinox. These dates fit well the time frame established for Göbekli Tepe on the basis of radiocarbon dating. Furthermore, Orion the constellation can be viewed as literally a torso in the sky with arms (but not legs), a headless hunter, similar to the iconography of the headless hunters represented by the central pillars of Enclosure D. Orion in the sky is most easily identified by its prominent "belt stars"—known simply as Orion's Belt.

The vernal equinox is easily observed and noted, and since the beginning of recorded history has been an important marker, celebrated with festivities. It marks the first day of the year in numerous calendars and is tied to cosmological creation stories. I suspect that these traditions go back to Göbekli Tepe times and even earlier. And, remember, the Great Sphinx, facing due east, faces precisely the location of the vernal equinox.

The Orion-Taurus region of the sky was a focus of ancient humans for tens of thousands of years in Europe and the Middle East. Here are located the asterisms of Orion's Belt and the Hyades, as well as the Pleiades. Orion and the Pleiades are explicitly mentioned in the Judeo-Christian Bible (see, for instance, Job 38:31 and Amos 5:8). Researchers such as Michael Rappenglueck, Frank Edge, and Luz Antequera Congregado have identified the constellation Taurus and the Pleiades among the paintings of Lascaux Cave in France, dating back 16,500 years ago (Seddon 2008; Thompson 2001–2007; Whitehouse 2000). Additionally, Rappenglueck asserts that a tiny tablet from Germany, carved of mammoth ivory and dating back at least 32,500 years, depicts the constellation Orion in the familiar guise of a narrow-waisted male figure with outstretched arms and legs (Whitehouse 2003). Given such evidence, it is reasonable that the Göbekli Tepe people recognized Orion as a human figure, even as a hunter. The animal remains found while excavating Göbekli Tepe (including leopards, a hyena, gazelles, aurochs or wild cattle, wild asses, foxes, red deer, Mesopotamian fallow deer, wild sheep and goat species, boars, chukar partridges, cranes, and vultures; see Batuman 2011, 78; Peters and Schmidt 2004; and Schmidt 2010), as well as the bas-reliefs on the pillars, can be taken to indicate a hunting society. Studying the anthropomorphic pillars of Enclosure D, they may represent, in stylized form, Orion. Not only do they havearms (which could be interpreted as the arms of Orion brought down to the body), but also

prominent belts (the belt stars of Orion) and fox pelt loincloths that may represent the Orion Nebula and associated features.

Interestingly, and I believe not merely coincidentally, Orion has been associated with other very ancient sites. In the Sahara Desert of southern Egypt, west of Aswan, is an area known as Nabta Playa. Here an ancient stone calendar circle, as well as many other megalithic erections and structures, has been identified by archaeologist Fred Wendorf, from Southern Methodist University, and his team and dated to circa 4000 BCE and earlier (Malville 1998).

Physicist Thomas Brophy (2002, 2012; see also Gaffney 2006) has carried out extensive analyses of Nabta. According to Brophy, three stones inside the Nabta calendar circle represent the belt of Orion (just as the three pyramids of Giza represent the belt of Orion according to the research of Robert Bauval; Bauval and Gilbert 1994). The stones on the playa and the corresponding stars in the sky aligned on summer solstice nights between about 6400 BCE and 4900 BCE. Brophy found even more correlations, however. Three other stones in the Nabta calendar circle correspond to the configuration of Orion's upper portions/shoulders as they appeared in circa 16,500 BCE, nearly half a precessional cycle earlier than the previously mentioned alignment. Based on these and other analyses of monoliths in the area, Brophy concludes that the early inhabitants of Nabta Playa possessed incredibly sophisticated knowledge, the type of knowledge we associate with high culture and civilization. Furthermore, the dates of the Nabta structures are in line with my dating of the oldest portions of the Great Sphinx as well as the dating of Göbekli Tepe, and at Giza, Göbekli Tepe, and Nabta apparently the constellation of Orion (which for the ancient Egyptians represented the god Osiris during dynastic times) was of prime importance.

My suggestion that the Göbekli Tepe people were observing the Orion-Taurus-Pleiades region of the sky on the morning of the vernal equinox is simply a hypothesis. If they were observing stars (versus the Sun, for instance), then they needed to readjust their observations over the centuries due to precessional changes. And maybe they were observing something more than just the Sun, Moon, planets, and stars.

Standing at the northern end of the stone circles of Göbekli Tepe, looking

toward the southern sky in the same direction as the anthropomorphic central pillars of Enclosure D, I wondered about the builders of this immense, and immensely sophisticated, site some twelve millennia ago. Clearly in my mind these were an enormously talented, technologically adroit, knowledgeable people. To my way of thinking, these were not mere primitive savages or barbarians, but a civilized people. But what does it mean to be civilized? What is civilization? Had the builders of Göbekli Tepe genuinely crossed the line from savagery to civilization? To address this question we need to turn to the issue of just what constitutes civilization. As we will see, opinions differ, but in the end I am convinced that the builders of Göbekli Tepe and the original Sphinx are representatives of a very early flowering of civilization, earlier than conventional archaeologists previously dreamed possible.

4

DEFINING CIVILIZATION

As he stood on the Pont des Arts in Paris, looking at the Institute of France on one side and the Louvre on the other and toward the Cathedral of Notre Dame, British art historian Kenneth Clark commented, “What is civilisation? I don’t know. I can’t define it in abstract terms—yet. But I think I can recognise it when I see it; and I am looking at it now” (Clark 1969, 1).

If we are to understand how the evidence of Göbekli Tepe, the redating of the Great Sphinx, and other developing data overturn and rewrite the old paradigms of how, when, and why sophisticated culture and civilization began, we need to examine the views, assumptions, and hypotheses that have prevailed among historians, prehistorians, and archaeologists for the last eighty years or so.

When and where did civilization begin? How far back in time does high culture go? Indeed, what do we mean by such terms as *civilization* or *sophisticated culture* and *high culture?*

When I was in college, more years ago than I perhaps care to remember, I learned the standard story that still holds sway in many circles: civilization and high culture date back to, at most, perhaps five or six thousand years ago. A handy marker for recognizing a true civilization was written language, and it was generally agreed that the earliest true writing could be dated to the late fourth millennium BCE (that is, circa 3500 BCE to 3000 BCE). The Sumerians are generally credited with developing writing about 3300 BCE to 3200 BCE, although the earliest Egyptian hieroglyphics may date back to the same period or even a century or so earlier, and there is also evidence of writing possibly from as far back as 3500 BCE found at Harappa, the Indus civilization, in what is now modern Pakistan (Whitehouse 1999; Wilford 1999). But then there are reports of

much earlier possible writing from Henan Province in China, dated at 6600 BCE to 6200 BCE, inscribed on tortoise shells (Rincon 2003). I recollect a book I read while still an undergraduate, *The Roots of Civilization* by Alexander Marshack (1972), which argued that various lines, notches, and "scratchings" on ancient bone artifacts dating to 10,000 BCE and earlier, before the end of the last ice age, were in fact symbolic systems, including lunar calendar notations. Maybe our ancestors were not so primitive and stupid after all.

Kenneth Clark, in his book and television documentary series, attempted to clarify what he (and so many of his viewers and readers) thought of as civilization. Referring to the medieval Norsemen (a term Clark uses interchangeably with Vikings), he wrote:

Unlike the earlier wanderers, the Vikings had a rather splendid mythology, romanticised by Wagner. . . . When one considers the Icelandic sagas, which are among the great books of the world, one must admit that the Norsemen produced a culture. But was it civilisation? . . . Civilisation means something more than energy and will and creative power: something the early Norsemen hadn't got, but which, even in their time, was beginning to appear in Western Europe. How can I define it? Well, very shortly, a sense of permanence. The wanderers and the invaders were in a continual state of flux. They didn't feel the need to look forward beyond the next March or the next voyage or the next battle. And for that reason it didn't occur to them to build stone houses, or to write books [Clark says this despite his previous comments about the Icelandic sagas being "among the great books of the world"]. . . . Civilised man, or so it seems to me, must feel that he belongs somewhere in space and time; that he consciously looks forward and looks back. And for this purpose it is a great convenience to be able to read and write. (Clark 1969, 14 and 17)

Maybe defining civilization and high culture in terms of a written language (or more accurately our knowledge of a recorded language, since we can easily miss things in the archaeological record) simply is not a fruitful approach. This is the conclusion I have come to while pursing my own research. But old ways of thinking die hard, and most archaeologists and historians still define civilization in terms of simple attributes such as having a written language. Why? In many respects the present mainstream paradigm, the paradigm that my work redating the Great Sphinx and the discovery of Göbekli Tepe threaten, can be traced back to the theories of one man, the great archaeological synthesizer V. Gordon Childe (1892–1957).

THE REVOLUTIONS OF PREHISTORY

Childe's primary goal was to establish an overarching theory of how and why civilization arose following a period of tens of thousands of years (or longer) when humans were biologically "modern" but still uncivilized. As part of his explanation, the Marxist Childe developed the key concepts of the Neolithic Revolution and the Urban Revolution (see Childe 1950; Bar-Yosef 1998), although in fairness to Childe, he was not a strict and dogmatic Marxist and the extent to which his politics influenced his science is open to debate (see Smith 2009, and references therein). Be that as it may, it is difficult to overstress the influence that Childe has had on subsequent scholars. In a recent review of Childe's contributions, Michael E. Smith wrote, "Often, this debt [to Childe's work] is acknowledged . . . but just as often scholars today go about their business without citing Childe. Nevertheless, the archaeological study of ancient complex societies is still dominated by the themes of urbanism, agricultural intensification and surplus, craft specialisation, social inequality, and the nature of power and the state, each of which was first applied to archaeological data in a systematic fashion by V. Gordon Childe and synthesised in his seminal paper in *Town Planning Review*" (Smith 2009, 22).

The paper Smith refers to is the 1950 article by Childe titled "The Urban Revolution," in which he outlined his basic concept of a "city" and thus the criteria to define and recognize "civilization." It is worth reviewing Childe's main points.

Building on the work of his predecessors, Childe distinguished three basic types of preindustrial societies, which he (and many others since) have referred to as savagery, barbarism, and civilization (these terms had already been applied as early as 1878 by Lewis Henry Morgan; see Smith 2009). Savages in this technical sense live off of wild foods that they obtain by hunting, fishing, gathering, foraging, and scavenging. Another, more acceptable modern term for such savages is hunter-gatherers (or gatherer-hunters, since in many such communities it may have been more the gathering, carried out primarily by women and children, perhaps, that really sustained the population).

Barbarians in the refined sense used by Childe might still hunt and gather to some extent, but they supplement their food supply by cultivating edible plants

and/or by herding and breeding animals. Cultivation and herding began with a group of people, a community, initially protecting plots of wild plants or groups of wild animals. This slowly led to more and more interference with the wild stocks, such as weeding, watering, irrigation, feeding, and selective breeding—ultimately culminating in the domestication of plants and animals (see North and Thomas 1977, 240, for comments on this subject). Fully domesticated organisms are in some cases unable to survive without human interference, such as plants that cannot grow without watering, weeding, and harvesting (their seeds may not break open and sprout on their own) or animals that no longer can exist in the wild because they have been bred to be docile or their coats have been bred to grow to such a length that they must be shorn or else the animal will suffer (think of sheep).

The transition from savagery (a primarily hunter-gatherer society) to barbarism (a society using cultivation, agriculture, and domestication to a significant extent) Childe termed the Neolithic Revolution, after the Neolithic Period—the "New Stone Age" of Europe. Childe stated (1950, 3), "Barbarism began less than ten thousand years ago with the Neolithic Age of archaeologists" (in modern terms the Neolithic Period is often dated to circa 10,000 BCE to 4000 BCE). Childe's contemporary, George G. MacCurdy, explained the implications of barbarism in 1926, stating, "The control of food supply made village life possible, and this in turn, led to societal organization, without which discipline, important works such as fortification, megalithic monuments, lake villages, etc., could never have been consummated" (MacCurdy, quoted in Bar-Yosef 1998, 1).

The next stage beyond barbarism, according to Childe, is civilization. Civilization, he admitted, can be difficult to define. The word itself comes from the Latin *civilis* and is related to the concepts of *civis* (citizen) and *civitas* (city or city-state). So, civilization can be equated with the concept of city life. As Childe wrote:

. . . and sure enough life in cities begins with this stage. But "city" is itself ambiguous so archaeologists like to use "writing" as a criterion for civilization; it should be easily recognizable and proves to be a reliable index to more profound characters. Note, however, that, because a people is said to be civilized or literate, it does not follow that all its members can read and write, nor that they all lived in cities. Now there is no recorded instance of a community of

savages civilizing themselves, adopting urban life or inventing a script. Wherever cities have been built, villages of preliterate farmers existed previously (save perhaps where an already civilized people have colonized uninhabited tracts). So civilization, wherever and whenever it arose, succeeded barbarism. (Childe 1950, 3–4)

This transition from barbarism to civilization, from village life to the development of true cities, Childe defined as the Urban Revolution. In using the word *revolution* for both the Neolithic Revolution and the Urban Revolution, Childe explicitly pointed out, "This must not of course be taken as denoting a sudden violent catastrophe; it is here used for the culmination of a progressive change in the economic structure and social organisation of communities that caused, or was accompanied by, a dramatic increase in the population affected. . . ." (Childe 1950, 3).

So for Childe (and so many other archaeologists, historians, prehistorians, sociologists, and anthropologists), the three fundamental evolutionary stages of humanity before the modern era (which might be dated to the Industrial Revolution, beginning in the eighteenth century) are:

Savagery (gatherers, hunters, and foragers)

Barbarism (cultivators, herders, agriculturalists, and husbandry practiced in village settings)

Civilization (urban living with literacy and other aspects of sophisticated, or high, culture, as we shall discuss further in the next section of this chapter).

Note that for Childe and like-minded thinkers, this series is both a hierarchy of stages from primitive (generally used to refer to savages and barbarians) to advanced (civilized peoples) and, for any particular people or geographic area, a progressive temporal sequence of development. Overall, humanity has progressed through these stages during the last ten thousand years, but at any one time (including the present) there may exist simultaneously on the face of our planet different groups in different stages of development (see Coon 1954; Weyer 1959).

Given his emphasis on urban life, cities, and literacy as being fundamental to civilization, Childe dated the origins of civilization in the Old World to circa five thousand years ago (we would now probably say circa 4000 BCE to 3000 BCE)

in three geographic areas: Egypt, Mesopotamia (the Tigris-Euphrates area, which includes the area where Göbekli Tepe is found), and the Indus River region of Asia (modern Pakistan and India). “It can be argued that all cities in the old world are offshoots of those of Egypt, Mesopotamia and the Indus basin,” Childe wrote (1950, 9). Independently in the New World, cities and civilization arose thousands of years later.

THE ELEMENTS OF CIVILIZATION

Childe (1950; see also the review in Smith 2009) enumerated ten basic criteria that he considered distinctive of cities, urban life, complex society, and civilization compared to either savagery or barbarism.

Cities and early civilization represented an increase in size and population density over all previous forms of settlement (Childe 1950, 9).

Cities included “full-time specialist craftsmen, transport workers, merchants, officials and priests” who were not themselves primary food producers or procurers (Childe 1950, 11).

Those who were the primary food producers or procurers (fishing, hunting, and gathering could still occur along with agriculture) paid a “tithe or tax to an imaginary deity or a divine king who thus concentrated the surplus” (Childe 1950, 11).

“Truly monumental public buildings not only distinguish each known city from any village but also symbolise the concentration of the social surplus” (Childe 1950, 12). More recently, however, Smith points out, “Nearly all ancient complex societies built some form of monumental architecture, but so did much earlier societies, such as the Neolithic groups that built Stonehenge and other megalithic monuments. Nevertheless, Childe was correct to point out that monumental buildings served as deliberate symbols of the power and wealth of early rulers . . .” (Smith 2009, 13).

“All those not engaged in food-production were of course supported in the first instance by the surplus accumulated in temple or royal granaries and were thus dependent on temple or court. But naturally priests, civil and military leaders and

officials absorbed a major share of the concentrated surplus and thus formed a ‘ruling class’” (Childe 1950, 12–13).

“They were in fact compelled to invent systems of recording and exact, but practically useful, sciences” (Childe 1950, 14). That is, scripts and forms of recording and writing were invented. Smith in his review of Childe’s criteria notes, “Writing, is often dismissed as a universal criterion of complex societies based on the absence of writing in the Inka [Inca] and earlier Andean states. If we broaden Childe’s concept to formal record-keeping [which the Inca and related societies had], however, then this was an important and universal characteristic of early states” (Smith 2009, 13).

“The invention of writing—or shall we say the invention of scripts—enabled the elaboration of exact and predictive sciences—arithmetic, geometry and astronomy” (Childe 1950, 14). This included calendars and sophisticated (at least for the times) mathematics. Smith in contrast, states, “The development of practical sciences, is a trait not limited to states; calendars and mathematics originated long before the early states” (Smith 2009, 13).

Particularly important for our discussion is Childe’s eighth distinguishing criterion, which I will quote in full. “Other specialists, supported by the concentrated social surplus, gave a new direction to artistic expression. Savages even in palaeolithic times had tried, sometimes with astonishing success, to depict animals and even men as they saw them—concretely and naturalistically. Neolithic peasants never did that; they hardly ever tried to represent natural objects, but preferred to symbolize them by abstract geometrical patterns which at most may suggest by a few traits a fantastical man or beast or plant. But Egyptian, Sumerian, Indus and Maya artist-craftsmen—full-time sculptors, painters, or seal-engravers—began once more to carve, model or draw likenesses of persons or things, but no longer with the naïve naturalism of the hunter, but according to conceptualized and sophisticated styles which differ in each of the four urban centres” (Childe 1950, 15). Smith comments that this “is the least useful and relevant trait for understanding the early states. While all of the early states had distinctive regional art styles, these were not necessarily any more sophisticated than the art of Neolithic groups. The social significance of visual art, however, underwent a major transformation in states, with most ancient rulers adopting an ideological (propagandistic) programme of visual representation that promoted their interests . . .” (Smith 2009, 14). Indeed, the

level of “sophistication” of artwork is arguably a subjective judgment, but to the art connoisseur not necessarily. Elements of style, composition, and technical ability are subject to more or less objective criteria by which art can be judged. I would contend that when such criteria are applied, the style and technical ability of the artwork seen at Göbekli Tepe are at the same level of sophistication as that seen among Egyptian, Sumerian, Indus, and Mayan artwork many thousands of years later.

“Regular ‘foreign’ trade over quite long distances was a feature of all early civilizations and, though common enough among barbarians later, is not certainly attested in the Old World before 3,000 B.C. nor in the New before the Maya ‘empire’” (Childe 1950, 15). As Smith (2009) notes, trade dates back well before civilization, probably to the earliest Paleolithic communities (or I would suggest perhaps even earlier), but it expanded greatly with the founding of city-states.

“So in the city, specialist craftsmen were both provided with raw materials needed for the employment of their skill and also guaranteed security in a State organization based now on residence rather than kinship” (Childe 1950, 16).

CHALLENGING THE PARADIGM

The concepts of the Neolithic and Urban Revolutions have influenced thinking on the origins of agriculture and civilization ever since Childe codified them in the last century, and as with any highly influential paradigm, often these ideas have been taken as unquestioned assumptions by later researchers. But in fact new data and research have poked holes in the when, why, and how of these very assumptions and the mainstream understanding that goes along with them. The story of the origins of civilization must be rewritten.

First is the matter of dating. Childe, based on the dating of the sites known in his time, believed that the beginning of barbarism—the transition to cultivation, herding, agriculture, and husbandry, that is, the Neolithic Revolution—began within the last ten thousand years. And it was only with this transition that settled village life, more complex societal organization, megalithic monuments, and the like could occur. Now there is clear evidence that both village life and megalithic monuments occurred earlier than Childe and his contemporaries imagined, and at a stage when food was still procured by gathering and hunting.

As a case in point, consider the settlements in the Levant (the region composing the modern area of Israel, the Palestinian territories, Jordan, Lebanon, and western Syria) that date back to circa 13,000 BCE to 10,000 BCE. Known to archaeologists as the Natufian culture, this culture apparently arose during the warming at the end of the last ice age, which brought a relatively wet climate to the Levant. There were abundant natural food supplies, from gazelles to hunt to wild barley, wheat, and rye to gather, which allowed the Natufians to settle down into permanent villages of up to several hundred people (Mann 2011, 56). Here we have villages not only earlier than Childe believed, but villages of savages—that is foragers, hunters, and gatherers—rather than cultivators or farmers.

Then the Natufians suffered setbacks with the abrupt cooling at the beginning of the Younger Dryas, circa 10,900 BCE to 10,800 BCE (the beginning of the end of the last ice age; see appendix 3), which also brought more arid conditions to the Levant. Local food supplies shrank and many Natufian villages collapsed, the people disbanding to wander in search of better regions. Some villages, however, may have tried to hang on, beginning to cultivate local plants such as rye, the first step toward true agriculture. This scenario for the origin of agriculture is diametrically opposed to Childe's ideas. For Childe agriculture came first, and it was agriculture that allowed adequate foodstuffs to support a settled population and village life. Agriculture, according to Childe, came before the establishment of villages (and all that goes along with villages and larger settlements, such as an increase in the level of societal organization, monumental megalithic architecture, and so forth). But here is evidence to the contrary, that village life came first and agriculture (necessitated by climatic deterioration) was a way to maintain village life.

Another aspect of what we can refer to as the Childean paradigm involves the origin of organized religion. Magic, including that which is generally now referred to as shamanism (see, for instance, Shirokogoroff 1935), was suited to and used by savages, by hunter-gatherers. True organized religion with a complex social hierarchy, a priesthood, and strictly enforced rules and codes of conduct, according to the reigning paradigm, came later with the establishment of village life based on cultivation and domestication. Organized religion was essentially a way to control the populace, maintain order, promote cohesiveness, and keep the society together and functioning as a whole without the annoyance of dissidents. It also justified the social hierarchy; rulers received their privilege

and power from the gods (later expressed as the divine right of kings). Childe, a Marxist atheist who was openly disdainful of organized religion, famously wrote, “Magic is a way of making people believe they are going to get what they want, whereas religion is a system for persuading them that they ought to want what they get” (Childe, quoted in McQueen 2011).

The bottom line is that formal organized religion was not necessary among savages, and true religion could not and did not develop until a stage of barbarism and sufficiently large permanent settlements based on cultivation and agriculture had been reached.

By Klaus Schmidt’s thinking, Göbekli Tepe overturns the “village life and barbarism precedes organized religion scenario” (see Schmidt 2006/2008, 2007, and the popular review in Mann 2011). Schmidt views Göbekli Tepe as a massive temple complex, the world’s oldest temple, built of incredibly carved megalithic blocks by foragers, hunters, and gatherers at the very end of the last ice, with the oldest constructions at Göbekli Tepe dating back to circa 10,000 BCE to 9000 BCE and intentionally buried by circa 8000 BCE. According to Schmidt, a magnificent temple complex was built in stone prior to the development of agriculture, but at a time when village settlements of foragers and hunters were taking place. The building and maintenance of Göbekli Tepe (and any priesthood associated with it) would have required organization and planning among large groups of people, perhaps gathering from tens and hundreds of kilometers away at the site of Göbekli Tepe to both create the structures and carry out rituals and religious ceremonies. Schmidt suggests that the development of cultivation and agriculture may have occurred as a way to be able to maintain large populations at Göbekli Tepe. In other words, organized religion and the need and/or desire for a magnificent religious complex were the driving factors that necessitated the invention of agriculture, rather than agriculture ultimately leading to village life, which then required organized religion. Once again, the Childean paradigm is turned on its head.

Of course, Schmidt’s hypothesis is based on the assumption that Göbekli Tepe is a temple or religious structure of some kind. This is far from clear, however. The figures on the central pillars of one circle in particular at Göbekli Tepe, with their arms, hands, belts, and loincloths, clearly are humanoid in form. Schmidt views these not as humans per se, but as supernatural beings, gods,

resembling humans. Schmidt suggests the animals abundantly carved on the pillars were “guardians to the spirit world” (Mann 2011, 57). Do we have here the first clear representation of anthropomorphic gods, the form of gods that would be predominant in so many later religions, including the classic mythologies of the Greeks and Romans and the Judeo-Christian concept of God, in the likeness of whom humankind was created? Or is Schmidt’s speculation here entirely off base? With the evidence at hand it is difficult to know. More to the point, however, the distinction between the sacred and the profane, the spiritual world and the everyday world, the numinous and the ordinary, between religion and science as we now understand the concepts, may not have applied over ten thousand years ago. Indeed, arguably these distinctions were much less relevant, and were rarely made, even as recently as five hundred years ago. In my opinion, it is inappropriate to apply our values and beliefs to an ancient people whom we do not understand.

THE FIRST ECONOMIC REVOLUTION

In the tradition of Childe’s “revolutions,” Douglass C. North (cowinner of the 1993 Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel, generally referred to as the Nobel Prize in Economics) and Robert Paul Thomas suggested another prehistoric change, which they dubbed the First Economic Revolution. These authors assert that for prehistoric humans, still in the most basic hunter-gatherer stage of development, all “natural resources, whether the animals to be hunted or vegetation to be gathered, were initially held as common property. This type of property right implies free access by all to the resource” (North and Thomas 1977, 234). There was no incentive on the part of any single person or small group of people to protect or save resources, for what would be the point? If one person or group did not use them, then another person or group would. As long as the concept of common property rights, without any restrictions whatsoever, prevailed, the concepts of cultivation, agriculture, herding, and husbandry would be doomed to failure. Imagine attempting to tend a garden or herd, only to have anyone at anytime come by and take whatever she or he desired. As North and Thomas write, “It is inconceivable that, from the very beginning, the first farmers did not exclude outsiders from sharing the fruits of their labours. Furthermore, the band was probably a small enough group to monitor easily the activities of its members to ensure that collective behaviour did not over-utilize the scarce protected land resource held in common by the

group” (North and Thomas 1977, 235).

The concept of private property in a modern sense was not required, but the concept of communal property was—property held in common by the group or band for the benefit of the group or band collectively. North and Thomas assert, “The band in principle at least could have exploited its opportunities in agriculture by constraining its members with rules, taboos, and prohibitions, almost as effectively as if private property rights had been established” (North and Thomas 1977, 235).

Thus, the invention and enforcement of communal property rights, the First Economic Revolution, according to these authors, is key in explaining the development of agriculture, which in turn (following the reasoning of V. Gordon Childe) ultimately led to the Urban Revolution. They summarize their view as follows: “When common property rights over resources exist, there is little incentive for the acquisition of superior technology and learning. In contrast, exclusive property rights which reward the owners provide a direct incentive to improve efficiency and productivity, or, in more fundamental terms, to acquire more knowledge and new techniques. It is this change in incentive that explains the rapid progress made by mankind in the last 10,000 years in contrast to his slow development during the long era as a primitive hunter/gatherer” (North and Thomas 1977, 241).

One wonders how the Marxist, materialistic, atheistic V. Gordon Childe might have reacted to this hypothesis. Perhaps he would have nodded in approval at the concept of the First Economic Revolution.

MODERN BIASES

The Neolithic Revolution. The Urban Revolution. The First Economic Revolution. These are the components of the conventional, mainstream, status quo paradigm of how and when civilization arose. In many ways the concept of revolutions as an explanation for the rise of civilization is both ethnocentric and anthropocentric. Let me explain what I mean.

Ethnocentric: That is, these theories are based primarily on the perceived way that humanity developed in Europe and Asia (and of course most of the theoreticians are Westerners) and particularly in the Middle East and Mesopotamia. Other cultures and peoples are then forced into the same

theoretical categories. I do not believe that we should impose our values and preconceptions on other cultures, ancient or modern.

Anthropocentric: These theories are focused on human development, either largely independent of environmental changes on Earth or at best rather downplaying such environmental changes. The classic reasoning is along the following lines: climate change has occurred many times over the tens of thousands of years that humans have existed anatomically and physiologically in modern form, so even if climate change impacted or helped propel the development of agriculture and urban life, it did so only when humans were mentally and socially ready for such developments, such revolutions. Classic anthropocentrism, regarding humans as the central element in history and indeed the most significant entity in existence, the be all and end all of the universe, has a long and hoary history in the West. It dates back to the concept that our Earth is the center of the universe and that we humans are the epitome of God's creation. Of course, scientifically we now realize that our Earth revolves around the Sun and that our Sun is just one of a virtual infinitude of stars in the universe. But I would venture to guess that many, perhaps most, people still consider humans somehow special and apart from nature. Even if they pay lip service to the concept that we are not quite so special, deep in their souls they are still primarily anthropocentric, and this is reflected in the way such people act in everyday life, not planning adequately (or at all) for "natural disasters" or other major environmental changes. One might go even further and argue that the ideological rigidity of some people (including some scientists) who insist even in the face of contradictory data that certain types of environmental change (global warming is an example) are solely due to human actions constitutes another form of anthropocentrism (I discuss the issue of climate change later, in chapter 8). Then there are those who openly proclaim, often on the basis of strong religious convictions, that humans are God's special creation. And in many cases, these same people go on to announce that they, their own ethnic or religious group, constitute God's chosen children in the divine scheme of history.

Ethnocentric and anthropocentric views (whether advocated explicitly or, perhaps worse, held unconsciously) can become mental straightjackets, hampering clear thinking on important issues, such as the how, when, and why of civilization—and what the future may hold for our modern civilization. As a geologist, I have long felt that there is a major disconnect between (1) the status

quo archaeological paradigm explaining the rise of civilization, and (2) the geological evidence for major environmental turmoil and catastrophe at the end of the last ice age and immediately afterward, circa 10,000 BCE to 8000 BCE, the time of Göbekli Tepe and the original Great Sphinx. Furthermore, the Western World, and the Middle East in particular, is not necessarily the exemplar of the rise of civilization (despite the fact that many Westerners, with their ethnocentric beliefs, feel it is). Where might we find a culture, a civilization, isolated from the West for centuries and millennia? Even India and the Far East of China and Asia have had contact for millennia with the Middle East and Mediterranean region.

When the ambassador invited Katie and me to join him on the expedition to Easter Island, it crossed my mind that this might be just what I needed to help clear my mind and gain a different, non-Western, perspective on the origins of civilization. Not only does Easter Island exhibit the remains of a clearly advanced megalith-building culture, but it is also the home of an indigenous script, the rongorongo, and as we have seen, writing is often taken as the hallmark of civilization.

So, let’s now examine Easter Island more carefully.

5

TE PITO TE HENUA (THE NAVEL OF THE WORLD), EASTER ISLAND

Easter Island is emblematic of ancient mysteries. Located in the remote South Pacific just south of the Tropic of Capricorn—some 3,700 kilometers west of mainland Chile and over 2,000 kilometers from any other inhabited island—it is often considered the most remote populated location on Earth. It is also known as Rapa Nui, Isla de Pascua, and Te Pito Te Henua; the latter name has been translated as “the navel of the world,” “navel and uterus,” or “ends of the land,” apparently referring to both the isolation of the island and the volcanic craters that compose it. The island is triangular in shape and so small that theoretically one can walk around its entire coast in two days.

The island remained bathed in secrecy, unknown to the Western world until its discovery by Dutch explorer Jacob Roggeveen on Easter Sunday 1722. The giant stone sculpted heads and torsos, known as moai, that are found in the hundreds on the island are megalithic mysteries that boggle the imagination. The average height and weight of the moai has been estimated at four meters and about twelve to thirteen tons, and the largest erected moai are up to ten meters tall and are estimated to weigh up to seventy-five tons. An unfinished moai still in the quarry is some twenty-one meters long with an estimated weight of perhaps 250 tons. How and why were they carved? By whom and when? These are still unanswered questions; to this day the moai have eluded our best efforts to truly decipher their meaning.

The standard modern “solution” to the enigma of Easter Island is that the earliest of the hundreds of moai were constructed, beginning around 1,000 to 1,500 years ago, when the first Polynesian settlers arrived on Easter Island, and that moai carving continued until around the seventeenth century, ceasing

shortly prior to European contact. The moai, according to this scenario, were essentially part of an ancestor and burial cult. The production of moai ceased as the Easter Islanders deforested their land and consequently brought environmental devastation to their tiny island, ultimately sparking tribal warfare, an impoverished society, and even cannibalism. But does this story, which in recent decades has gained wide circulation in both scientific and popular circles, really stand up to scrutiny? A clear analysis of the evidence does not convincingly support the "natives destroyed their environment" scenario (Peiser 2005). Rather, this may simply be a Western myth that both masks the destruction brought to the island and culture by European contact (which included notorious slave raids and effective genocide) and denies the true magnificence, antiquity, and high cultural and technological achievements of Easter Island civilization.

It was with such thoughts in mind that in January 2010 Katie and I, along with the ambassador, his family, and a few friends, undertook our short reconnaissance excursion to Easter Island to look into the mysteries for ourselves.

THE CHRONOLOGY AND DATING OF THE MOAI

The standard story of Easter Island does not detail the relative dating of the various moai and in fact relegates all of these statues to a fairly late time period, beginning on the order of approximately 1,000 to 1,500 years ago at the most.

Studying the moai with a geological eye, I was particularly impressed by the varying degrees of weathering and erosion seen on different moai, which could be telltale signs of major discrepancies in their ages. The levels of sedimentation around certain moai also impressed me. Some moai have been buried in up to an estimated six meters of sediment, or more, such that even though they are standing erect, only their chins and heads are above the current ground level. Such high levels of sedimentation could occur quickly, for instance, if there were catastrophic landslides, mudflows, or possibly tsunamis washing over the island, but I could not find any such evidence (and landslides or tsunamis would tend to shift and knock over the tall statues). Rather, to my eye, the sedimentation around certain moai suggests a much more extreme antiquity than most conventional archaeologists and historians believe to be the case—or believe to

be possible.

Not only does sedimentation around the statues suggest a longer and different chronology than conventionally accepted, but so too do weathering and erosion patterns and stylistic considerations. Although on one level most of the moai are stylistically similar and even stereotypic, at another level each is unique, and they could, I believe, be categorized according to stylistic types. The moai should, in addition, be sorted according to lithology (rock type) as well as weathering and erosion levels (taking orientation and relative exposure to the elements into account). Another key to solving the problem will be to compare weathering, erosion, and sedimentation rates in historical times. I have begun to gather photographs of various moai and landforms on Easter Island taken over the last 130 years so as to compare them geologically to their conditions today, and in this way attempt to get a quantitative handle on weathering, erosion, and sedimentation rates. So far, it seems that sedimentation over the last century has been on the whole relatively modest.

Even on our preliminary reconnaissance trip I found evidence that the earliest moai may have differed materially from the later moai. The earliest moai appear to have been more finely worked from hard basalts as compared to the volcanic tuffs from which most moai, dated to later periods, were carved. The few surviving basalt moai have either been found at deeper stratigraphic levels, below other moai and the platforms on which later moai were erected, or the basalt moai were reused in later structures, thus indicating the basalt moai are among the earliest on the island. For instance, the famous basalt moai now in the British Museum was collected in 1868 from inside a stone structure at Orongo where it had been reused, and its back was partially recarved at a later period than the original statue (Van Tilburg 2007). Furthermore, at least one of the basalt moai (now housed in the museum on Easter Island) is, as previously mentioned, of a very strange form; with an elongated head and well-defined breasts, it is often considered a female while virtually all other moai are apparently males.

Another major puzzle, which is directly applicable to the chronology and dating of the moai, is the matter of where various moai were quarried. Quarries on the rim of the volcanic crater, where large moai were carved from the volcanic tuffs, are well exposed and still contain partially carved moai in place. I

inspected these quarries carefully. However, the quarries where the few basalt moai were carved have never been definitively located, despite the small size of the island. Based on the geology of Easter Island, I expect that any suitable basalt deposits would occur lower in the stratigraphic section, so low in fact that they might currently be under sea level off the coast of the island. That is, the basalt quarries might be underwater. How could this be? It is difficult to conceive that the ancient Easter Islanders were quarrying rock below sea level. Alternatively, the "lost basalt quarries" might be under sea level now because they are of extreme antiquity, and thus the basalt moai carved from them are extremely ancient. Sea levels have risen dramatically since the end of the last ice age, some ten thousand or more years ago, and if the basalt moai were quarried along the coast of Easter Island from areas since inundated by the sea, this could help to date the basalt moai and is immediately suggestive that they are thousands of years older than conventionally believed to be the case.

The key to solving the puzzle of the basalt moai is to locate the quarries. If they are found underwater along the coast, their depth and geological setting will shed light on their age and could lead to a major revolution in our thinking about the age, origin, importance, and sophistication of Easter Island culture. For one thing, while the later standard moai carved of volcanic tuffs could be relatively easily cut out of the rock using the primitive tools found in abundance on the island, the same cannot be said for the apparently earlier and more sophisticated basalt moai, which may have formed the model and set the standard for the later volcanic tuffs moai.

A fascinating Easter Island legend relates that one of the founders, King Hotu-Matua, came from a land called Hiva that was said to be slowing sinking below the sea (Mazière 1968). Is this suggestive of a people fleeing rising sea levels, perhaps thousands of years ago at the end of the last ice age when sea levels were rising worldwide? Was the initial colonization of Easter Island prior to the final, highest, post–ice age rises in sea level, such that when first colonized it was a larger and more prominent island? Such a scenario would be compatible with the early carving of basalt moai from quarries along the coast that have since been submerged.

It is already more than pure speculation that the basalt moai may have been quarried from areas that are now underwater. While on the island we heard of reports that when the French marine explorer Jacques-Yves Cousteau (1910–

1997) and his divers visited the island they came across some very rectangular-looking holes or cavities in the basalt layers located off the coast. Could these indeed be ancient quarries? We began to track down leads as to divers, still on the island, who were with Cousteau's team and are willing and able to take us to these sites. It is our hope to dive and explore the possible quarries for ourselves on a return trip.

HOW WERE THE MOAI MOVED?

To this day, no one is absolutely certain how the moai were transported. Numerous theories involving brute manpower, ropes, wedges, levers, sledges, rollers, and so forth have been proposed. However, as Francis Mazière has perceptively pointed out:

One of the great problems that dominate Easter Island archeologically is the question of how the statues were moved to the ahu [ceremonial platforms on which they were erected], some of which are miles [kilometers] from the quarry. This problem has never been solved, and even the work of the Norwegian expedition of 1956 brought no answer, for [Thor] Heyerdahl's attempt at moving a moaï was in no way conclusive for . . . it was one of the smallest, and because it was dragged along by means of ropes over a very particular ground that exists nowhere on the island except at Anakena—sandy ground without any rocks sticking out of it. (Mazière 1968, 133)

Some traditional Easter Island legends state that the moai "walked" from the quarry to their final locations. This has been interpreted as indicating that the statues were raised upright, perhaps supported in slings hung from poles above, and then pivoted or rocked back and forth on their bases, thus moving them from one place to another; that is, they "walked." But was this really or always the case?

Another widespread Easter Island tradition is that the moai were transported by *mana*, that is, by supernatural forces or powers. As Katherine Routledge (1866–1935), who carried out extended exploration of Easter Island in 1914 and 1915, wrote, "The natives are sometimes prepared to state that the statues were thrown down by human means, they never have any doubt that they were moved by supernatural power. We were once inspecting an ahu built on a natural

eminence, one side was sheer cliff, the other was a slope of 29 feet [9 meters], as steep as a house roof, near the top a statue was lying. The most intelligent of our guides turned to me significantly. 'Do you mean to tell me,' he said, 'that that was not done by *mana*?'" (Routledge 1919, 198, italics in the original).

Alfred Métraux (1902–1963, a Swiss ethnologist who studied Easter Island extensively) wrote, "When the Easter Islanders of today are asked about the means by which the statues were transported, they only say: 'King Tiikoihu, the great magician, used to move them with the words of his mouth'" (Wolff 1948, 157, citing Métraux 1939, 771).

The concept of mana is not generally considered scientific and thus is simply dismissed by most Western archaeologists and historians, but does it mask something we do not know? Perhaps a profound mystery that has yet to be uncovered? I take a serious scientific interest in the paranormal, and based on my research, I have concluded that there is strong evidence in some cases for the reality of psychokinesis (that is, the movement of matter via mental means alone, sometimes referred to as telekinesis; see Burns 2003; de Martino 1972; Owen with Sparrow 1976; Roll 2003; Schoch and Yonavjak 2008, and references cited therein). Some of the best-documented cases of psychokinesis (once we have excluded fraud and delusion) are relatively spontaneous and unplanned, such as so-called poltergeist phenomena (in modern terminology often referred to as recurrent spontaneous psychokinesis, or RSPK).

Is it possible that the moai were moved paranormally? Did mana indeed have a role to play? I cannot say for certain, but I believe we should be open to the idea. In appendix 4 to this book I speculate on the possibility that modern parapsychological insights into psychokinesis combined with a particular theory of gravity may provide a major clue to the mechanism underlying psychokinesis, and ultimately perhaps how the moai were moved. Oddly, the psychotherapist Werner Wolff (1904–1957) seriously suggested that the moai had flown through the air, not via parapsychological mana, but by "natural mana," that is, by the explosions of the volcano where the moai were carved.

Since great blocks of lava have been discharged by the volcanoes, why could such blocks not have been ejected after being shaped by sculptors in the workshop of the crater? This theory, in a way, would explain the so-called magic

transportation, although imagining giant-statues flying through the air like ghosts seems a fantastic dream. Unconsciously, perhaps, each investigator has dismissed such a possibility; it does seem strange enough that this angle has never been discussed. . . .

But the idea of flying statues did not seem strange to the natives—the concept was within the sphere of their imagination. C. E. Fox reports such a concept from San Christobal in the Solomons: “Levitation is described as common both in the case of sacred stones and of priests, some of whom were levitated large distances through the air.” (Wolff 1948, 156, citing Fox 1924, 338)

As a geologist, I question whether moai were moved by volcanic power. Although carved of solid rock, I doubt that any moai would have survived intact after being shot like a missile from the volcano and then crash-landing on the ground. And I wonder how many human sculptors might have been killed, or how any could have survived, while working in a volcanic crater that was on the verge of erupting. And think of all the moai that may have shot out of the volcano only to land in the ocean surrounding the tiny island.

Interestingly, despite the emphasis on mana as the way the moai were moved, as recorded by Katherine Routledge, J. Macmillan Brown reported that the Easter Islanders did not even have a native word for mana. Brown resided on the island for five months in the early 1920s (some of the photos reproduced in his 1924 book are dated to 1922) and interviewed and worked with some of the same informants as did Routledge. Brown wrote, “[An] important *lacuna* [in the Easter Island vocabulary] is the word *mana,* which in Polynesian covered all that occult power which resides, not only in the supernatural and the ancestors, but in great living men and their deeds and their weapons and instruments. It was probably that there was no sense of this *aura* of the great and indeed no great individuality to embody it or ray it forth that the word dropped out of their Polynesian vocabulary” (Brown 1924, 279; italics in the original). Thus, Brown is not contending that the Easter Islanders of his time did not believe in mana, but simply that they did not have, or no longer had, a native word for the concept. Indeed, one might speculate, this was because the mana was no longer manifested on Easter Island after the population had been decimated and the indigenous culture all but eradicated in the wake of European contact beginning in 1722.

LEGENDS OF GIANTS

Sometimes it is suggested that the moai were huge simply because the peoples inhabiting an ancient Easter Island were huge. Indeed there is some, if at this point only very scanty, evidence that besides the giant moai, there may have been other giants on Easter Island. Literal living giants, that is. C. F. Behrens, who accompanied Roggeveen on the voyage that marks the generally accepted European discovery of Easter Island in 1722, reported, “With truth, I might say that these savages are all of more than gigantic size. The men are tall and broad in proportion, averaging 12 feet [3.65 meters] in height. Surprising as it may appear, the tallest men on board of our ship could pass between the legs of these children of Goliath without bending the head. The women can not compare in stature with the men, as they are commonly not above 10 feet high [3 meters]” (Quoted in Thomson 1891, 462).

What do we make of such a report? Could this be real?

Interestingly, traditional legends from the island of Flores, Indonesia, describe the existence of a race of diminutive people known as the Ebu Gogo (BBC 2004). Recently a new species of humans, *Homo floresiensis*, popularly referred to as hobbits, has been found on Flores that may fit the description of the Ebu Gogo (Brown *et al.* 2004). The existence of *H. floresiensis* is based on subfossil remains from the end of the last ice age, as recent as twelve thousand years ago. However, some serious researchers have hypothesized that hobbits survived as a relict population until possibly as late as the nineteenth century (Sereno 2005, 9). Likewise, could the early reports of Easter Island be factual? Stories of giants are reported in sacred texts, myths, and legends around the world. Might these legends have a basis in fact? Might a relict population of giants have survived on Easter Island up until European contact? In this context it is worth pointing out that a study of skeletons from Greece and Turkey documented an average drop in height of about fifteen centimeters from the end of the last ice age (circa 10,000 BCE) to 3000 BCE, and modern people in this region are still not as tall on average as their ancestors of some twelve thousand years ago (Batuman 2011, 81).

The discovery of solid physical evidence for giants on Easter Island would revolutionize our thinking about the ancient past, shedding new light on many

myths and legends, and force us to rethink the development of humans through time.

The reports of giants on Easter Island tie in with another mystery: what was the origin or origins of the original peoples who inhabited the island? Most archaeologists and ethnologists concur that there are strong Polynesian influences in known Easter Island culture, but others, most notably the late Norwegian adventurer Thor Heyerdahl (see the summary in his book *Easter Island: The Mystery Solved*, 1989), have argued that there were at least some South American elements and influences in native Rapanui culture. For instance, various building techniques used in some of the ceremonial platforms have been pointed to as being more South American than Polynesian, as has an anomalous kneeling moai excavated by Heyerdahl's archaeological team in the 1950s (almost all other moai are apparently standing rather than kneeling, but actually lack legs).

A possibility that is rarely discussed but should be considered is that various cultural traits originated on Easter Island and spread both west, to Polynesia proper, and east, to South America. This hypothesis would be strengthened if it can be shown that the Easter Island civilization has an extreme antiquity and dates back to a time when sea levels were lower at the end of the last ice age (as discussed previously in this chapter) and the island was geographically larger and more prominent.

Adding to the enigma is the distinct possibility that Easter Island was "discovered" and colonized by two or more peoples or races in pre-European contact times. Persistent local legends recount that there were two groups on the island, referred to as the Hanau Eepe and the Hanau Momoko. These names have been translated into English as the "longears" (referring, apparently, to the artificially distended or elongated earlobes) and "short-ears," respectively, but the terms might also refer to being stout or big versus normal size. According to some traditions and interpretations, the Hanau Eepe were also characterized by lighter skin tones and sometimes-red hair, as opposed to the darker Hanau Momoko. Certain traditions relate that the Hanau Eepe brought moai carving and other civilized arts to Easter Island and that they generally dominated, and even enslaved, the Hanau Momoko. This situation ended when the Hanau Momoko rebelled against their masters, drove the Hanau Eepe to one corner of the island,

and in an epic battle killed all or almost all (traditions vary) of the Hanau Eepe. Were the Hanau Eepe giants, of whom a few survived into the eighteenth century and were seen by Behrens?

BIRDMEN PETROGLYPHS AND OTHER ANOMALIES

Easter Island is well-known not only for its gigantic moai, but also for its carvings on stones and boulders, the petroglyphs (see Lee 1992). Many of these petroglyphs are of so-called birdmen and apparently relate to the birdman competitions. Associated with the ceremonial center of Orongo, and persisting into the nineteenth century, these consisted of annual displays of skill and endurance as competitors swam to a small island (islet) off of the main island and vied to be the first of the season to acquire an egg from the migratory seabird, the sooty tern. The winner and his clan were conferred with prestige and power for the following year. But was there something more underlying the birdman competition and its associated petroglyphs? Did the competition originate with some long forgotten event in the deep past, and did the final forms it took represent a degenerate version of a once more profound ceremony? I really have to wonder.

Exploring Easter Island firsthand, I quickly became convinced that the standard, and rather mundane, explanations for the island's remarkable indigenous civilization and its achievements do not necessarily hold up under detailed examination. On Easter Island are found low, thick-walled stone structures that appear to be constructed as if they were made to withstand a direct hit from a powerful aerial bomb. And then there is perhaps the biggest Easter Island mystery of all: that of the enigmatic pieces of wood inscribed with mysterious glyphs—the rongorongo tablets. Before we can understand how the stone shelters and rongorongo fit into the bigger picture of the origin and demise of the earliest civilizations, we need to go back in time, to the end of the last ice age.

6

THE END OF THE LAST ICE AGE

At the end of the last ice age, some twelve thousand years ago, Earth underwent dramatic, cataclysmic changes. It was not simply a matter of the climate gradually warming and the glaciers melting. No, something very sudden and very unusual took place, unlike anything, by orders of magnitude, that we have experienced since. The civilizations and high cultures of that remote time were either utterly destroyed or thrown for a mighty setback. Knowledge was lost, order devolved to chaos, and a dark age lasting thousands of years ensued. Yet, not all records were lost. Unrecognized until recently, consistently repeated petroglyph forms (engravings on rocks) around the globe reproduce what ancient peoples observed. Mirroring those petroglyphs are Easter Island's mysterious and barely known rongorongo texts, which may record in greater detail what happened when our world was thrown into turmoil.

THE YOUNGER DRYAS

Approximately fifteen thousand to eleven thousand years ago Earth experienced a series of climatic fluctuations. It had been extremely cold, with continental glaciers extending much farther than they do today, but the climate started to warm. Then there was a short cold spell, known as the Younger Dryas, before the final warming and the "official" end of the last ice age. Geologists have long argued over how quickly or gradually Earth's climate can change from very cold glacial conditions to modern-like conditions, and vice versa. The classical view is that such changes may happen very quickly from a geological perspective, perhaps over a few hundred to a thousand years or more, but relatively gradually from a human perspective. The latest research indicates otherwise.

Studying Greenland ice core data, from which temperature and climatic history can be extracted by analyzing changes in various isotopes and dust

content at a virtually year-by-year scale, Jørgen P. Steffensen, of the Niels Bohr Institute at the University of Copenhagen, and his colleagues determined that such climatic transitions can in some cases occur in only a few years (Steffensen *et al.* 2008). They also pinpointed relatively precise dates for the climate changes. According to their study, the cooling that marks the beginning of the Younger Dryas dates to about 10,900 BCE. This cooling was very rapid from a geological perspective, but while some parameters show transitions over just a few years, other factors (for instance, changes in the dust record) are more gradual and seem to have responded much more slowly. The warming at the end of the Younger Dryas, which also heralds the end of the last ice age, began about 9700 BCE and may have occurred within an incredible three years—for all practical purposes instantaneously; given our current inability to resolve the finest details of something that happened so long ago, it may have literally happened overnight.

How do we explain this pattern of abrupt climatic shifts? Being a geologist, I view Earth and our environment as unstable, full of unexpected surprises, at least over the long term. Climates change, sea levels rise and fall, volcanoes erupt, earthquakes rock the land and sea, and objects fall from the sky. In previous works I have discussed how such natural cataclysms may have influenced the history of ancient civilizations (see Schoch with McNally 1999), and in particular I have pointed out strong evidence that Earth has experienced a series of encounters with comets or other similar natural phenomena (such as meteorites and asteroids) during historical and prehistoric times. There is evidence for impacts or close encounters with extraterrestrial objects around 7600 BCE, 4400 BCE, 3150 BCE, 2345 BCE, 1628 BCE, 1159 BCE, 207 BCE, 536 CE, and 1178 CE (Schoch with McNally 2003; undoubtedly this list is incomplete, especially for the period prior to 3150 BCE). Depending on the severity of the encounter (size of the comet, whether it actually touched the surface of Earth or perhaps resulted in a midatmosphere explosion, and so forth), dramatic climatic changes could be effected on Earth, which in turn could affect sea levels, and weather extremes can wreak havoc on animal and human populations, causing famines (see Than 2009 for a discussion of the effects of a sixth-century-CE cometary event). Bottom line, based on all the evidence, there is no doubt in my mind that these incidents, these cosmic catastrophes, had a profound influence on ancient civilizations. In some cases migrations were

sparked; in other cases entire cultures may have been wiped out.

In 2003 I suggested that the end of the last ace age may have been brought about in part by comets bombarding Earth (Schoch with McNally 2003). A comet hitting the land or shallow ocean or exploding above the land's surface may have scattered dust and debris into the atmosphere, causing global cooling, which, although relatively sudden, would take some years to reach its full extent. This pattern fits well with the cooling at 10,900 BCE. Since I first hypothesized such an event, evidence of a comet exploding over North America circa 10,900 BCE has been presented (Firestone *et al.* 2007; and see appendix 5).

What about the warming event of circa 9700 BCE? Initially I hypothesized that comets hitting not the land or shallow water, but the deep oceans, may have brought about this warming. A comet, I speculated, might break the thin oceanic crust, releasing heat from the hot magma beneath. Vaporized and displaced water would rain down on Earth, and tsunamis would wash across coastal areas, all serving to warm the planet and bring the ice age to a final end. But even with a comet, or a series of comets, bombarding the oceans, could the warming happen as quickly and dramatically as the Greenland ice cores suggest? Should comets be implicated in a warming transition, or does the evidence rather suggest that comets will in most cases cause a cooling event? But if not comets, what?

THE FOURTH STATE OF MATTER

My attention has recently turned to another outer space phenomenon: plasma, which is composed of ionized particles and associated intense electrical and magnetic phenomena that may originate as an outburst from our Sun or possibly from the interactions of other extraterrestrial objects, such as a close flyby of an electrically charged asteroid or comet or maybe even a large object colliding with our Sun. The concept of a big chunk of rock or ice from outer space—a meteor, comet, or asteroid—colliding with Earth is easy to grasp. But plasma? Plasma is not necessarily readily familiar to the average person. Sometimes referred to as the fourth state of matter (in addition to solids, liquids, and gases), plasma consists of ions (electrically charged atoms or particles) and constitutes such familiar phenomena as lightning, fire, and the glowing material in a neon tube. The northern and southern polar lights—the auroras—are plasma

phenomena, caused by the interaction between the solar wind (plasma emitted by the Sun) and Earth's magnetic field and magnetosphere.

Today lightning is a relatively minor weather phenomenon, and the auroras are little more than pretty lights in the sky, offering no threat to the inhabitants on Earth, but I do not believe this was always the case. In particular, our Sun is not as stable as most people generally believe. It undergoes relatively regular small-scale variations, such as the eleven-year sunspot cycle, as well as longer-term patterns (perhaps on the order of millennia and more). Presently unpredictable instabilities of the Sun can result in mass ejections of plasma (solar storms) that may reach Earth with far-ranging consequences. An 1859 solar storm, the Carrington Event, though relatively tame from a geological perspective, resulted in unusual auroras seen around the world. Additionally, telegraph systems failed. If an equivalent solar storm hit today, possibly our modern electrical grids and communication systems would be devastated, with untold consequences.

Arguably the Carrington Event was minor compared to other past events. In 1962 the astrophysicist and professor of astronomy at Cornell University Thomas Gold (1920–2004; recipient of the Gold Medal of the Royal Astronomical Society in 1985) wrote:

The question I would like to tackle is whether solar outbursts of the present day [such as the 1859 event] are representative of all that has happened in geologic times or whether much greater outbursts have occurred from time to time. Our evidence that nothing very violent has taken place in historic times is concerned with such a short span of time only that it cannot answer the question. . . .

For one big outburst every ten thousand years, for example, . . . the earth's magnetic field could clearly not hold up the incoming gas, and it would indeed drive down to the atmospheric level. . . . This breakdown would be in the form of a series of sparks, burning for extended periods of time and carrying currents of hundreds of millions of amperes. One might search whether there is any geological record of surface fusing and vitrification of rock or sand which cannot be accounted for by volcanic or meteoritic events. (Gold 1963, 159, 161–63; quoted in Peratt *et al.* 2007, 778–79; and Peratt and Yao 2008, 2)

RECORDS ENGRAVED ON ROCKS

Four decades later, Anthony L. Peratt, a plasma physicist with Los Alamos National Laboratory, addressed the topic that Gold discussed (Peratt 2003). Powerful plasma discharges, much more powerful than the auroras observed in the present day, form structures known as plasma columns that can expand in some places and constrict or narrow in other places (due to "pinch instabilities"). In profile these plasma columns can form donut shapes and may look like intertwining snakes, a stack of circles, or even resemble human stick figures (the so-called "stickman" or "squatting/squatter man" figures; van der Sluijs and Peratt 2010). In the modern day, powerful large-scale electrical discharges known as sprites occasionally occur in the upper atmosphere (about 80 to 140 kilometers above the surface of Earth). Some sprites take on stick figure forms and other shapes comparable to those of the plasma columns. Based on Peratt's models and experiments, in some cases the stick figure will have an upper cup shape (head) that has the appearance of a bird in profile. Peratt and his colleague W. F. Yao record that observers of the Carrington Event reported seeing "figures in the sky as if drawn with fire on a black background" (Peratt and Yao 2008, 3).

Peratt has studied ancient petroglyphs found around the world that are not only remarkably similar to one another, but also apparently record with a high degree of accuracy the configurations that intense electrical and high-energy plasma phenomena would form in the skies. He and his colleagues (Peratt *et al.* 2007; see also van der Sluijs and Peratt 2010) have recorded and analyzed the orientations of innumerable petroglyphs spread over 139 countries, and not only do they share many similar morphologies, but they are also characterized by similar orientations. The petroglyph locations generally have a distinct southern field-of-view, and Peratt and Yao concluded that the associated plasma phenomenon showed "relativistic electron flow inward at Earth's south polar axis and hypervelocity proton impacts around the north polar axis" (Peratt and Yao 2008, 1). Intense radiation, including X rays and synchrotron radiation would have been given off (synchrotron radiation is the result of charged particles moving at relativistic or ultrarelativistic velocities, that is close to the speed of light, passing through magnetic fields).

THE EASTER ISLAND CONNECTION

I was aware of Peratt's work, and through Peratt I knew of Gold's speculations, but until recently I had not given them ample consideration—not until Katie and

I returned from our brief excursion to Easter Island. Reiterating from chapter 1, one evening Katie suggested that we rewatch the video written and narrated by David Talbott, *Symbols of an Alien Sky* (Talbott 2009), which features Peratt's work connecting petroglyphs and plasma. As we watched, Katie suggested that the rongorongo script looks much like Peratt's petroglyphs and that it too might be a record of plasma phenomena in the ancient skies. It was a moment to give pause. Studying the rongorongo intensely, these enigmatic hieroglyphs, just like the petroglyphs, indeed appear to reproduce intense electrical and plasma phenomena. We see the same donut-like and intertwining shapes, the same odd humanoid figures, the same bird-like heads. The similarities are undeniable.

Although the Western discovery of Easter Island dates to Easter Sunday 1722, not until the 1860s did Europeans became aware of rongorongo. Unfortunately between missionary zeal, attempts to separate new converts from old pagan ways, and internecine warfare, almost all of the rongorongo tablets were burned or otherwise destroyed. Today just upward of two dozen remain (Fischer 1997b). Furthermore, natives literate in rongorongo were killed in fighting, succumbed to disease, or were carried off in slave raids. By the late nineteenth century, no one could genuinely read the rongorongo script.

Not only have the rongorongo tablets remained, until this point, undeciphered, but also there was no agreement among researchers concerning even the fundamentals of rongorongo. How far back in time it may go is a subject of debate. Some scholars have asserted it was invented on Easter Island during the late eighteenth century in imitation of European writing the natives had observed. A researcher in this camp is the linguist Steven Roger Fischer. After years of study, Fischer concluded it was a post-European contact invention. Furthermore, according to Fischer, the majority of the surviving rongorongo texts are cosmogonies or procreation chants that repeat, over and over, the generic formula of X copulates with Y to form Z. An example: "All the birds copulated with the fish: there issued forth the sun" (Fischer 1997b, 259). In other words, the rongorongo tablets are an Easter Island Kama Sutra! Fischer's "decipherment" has not received widespread acceptance.

Other researchers suggest the rongorongo script has an ancestry thousands of years old, though the surviving wooden tablets are at most a couple of hundred years old. The known tablets are copies of copies of copies . . . For many centuries scribes, not able to truly read the script, piously copied and recopied

something they knew was important and held in reverence. Brother Joseph-Eugène Eyraud wrote in 1864, “But the little they [the Easter Islanders] make of these tablets persuades me to think that these characters, probably a script in origin, are for them now just simply a custom they preserve without attempting to account for it” (Fischer 1997b, 12).

Far from being an indigenous creation of the Easter Islanders, some researchers have suggested the rongorongo script originated in parts of Polynesia well west of Easter Island, or perhaps even in China. Others look to South America. Still others have seen similarities between rongorongo characters and the enigmatic ancient scripts of the Indus Valley civilization. One researcher seriously suggested that rongorongo is related to Egyptian hieroglyphics (for general discussions of these theories, see Fischer 1997b; Métraux 1957; and Wolff 1948). I have long advocated that there is good evidence supporting cultural contact across both the Pacific and Atlantic Oceans in remote ancient times (Schoch with McNally 2003), but looking carefully at such rongorongo analyses, I do not find them particularly convincing. A stylized fish, human figure, Sun, or vulva could conceivably look similar across unconnected cultures.

Perhaps treating rongorongo as a script, as a form of writing comparable to an alphabetical language, or even as a script based on pictographs, ideographs, or hieroglyphics is a wrong or incomplete approach. This brings us back to the plasma hypothesis. Like the petroglyphs that Peratt has studied (Peratt 2003), I believe the rongorongo tablets record plasma configurations in the very ancient skies. Each glyph may show one of the forms the plasma column took. In sequence, they record, like a scientific record, what was happening in the skies. Supporting this interpretation are Rapanui words and legends. Explorer Francis Mazière recorded an indigenous name for the island as Matakiterani, or “eyes gazing at the sky” (Mazière 1968, 9). He also recorded a legend of the sky falling (Mazière 1968, 57):

In the days of Rokoroko He Tau the sky fell.

Fell from above on to the earth.

The people cried out, “The sky has fallen in the days of King Rokoroko He Tau.”

He took hold: he waited a given time. The sky returned; it went away and it stayed up there.

This legend could refer to strange plasma configurations, perhaps even manifested in part as tremendous bolts of lightning, seen in the sky and making contact with the land. Subsequently the plasma "went away" and the sky returned to normal. The legendary king's name bears a striking similarity to *rongorongo,* and Tau is similar to *ta´u*, a category of inscriptions commemorating a series of deeds or events (Fischer 1997b, 288). When a staff covered with rongorongo texts was collected in 1870 by Chilean naval officers, the commander, Don Anacleto Goñi, reported that the natives could not decipher them, but "we, in asking explanations of the natives about said staff, were shown the sky and the hieroglyphs that [the staff] contained with such respect that I was inclined to believe that these hieroglyphs recalled something sacred" (Fischer 1997b, 26; material in brackets added by Fischer).

Curiously, the few surviving rongorongo tablets have many sequences of glyphs in common. This suggests they are based on a common source, they are recording the same phenomena, and they fit together to form a complete whole. It is similar to finding ancient manuscripts in the Middle East. Piecing together fragments of the book of Daniel, for instance, the entire work emerges.

Here is another enigma: Easter Island lies some 3,700 kilometers west of the coast of South America. On the mainland, in modern Peru, are found the Nazca lines and geoglyphs—huge drawings on the ground. Curiously, some of these drawings are hauntingly reminiscent of both Peratt's petroglyphs and rongorongo glyphs. Are the Nazca geoglyphs part of the same story? Peratt and his colleagues (Peratt *et al.* 2007; Peratt and Yao 2008) mention the Nazca lines and Nazca pottery decoration as possible depictions of plasma phenomena. I see similarities between Easter Island petroglyphs, rongorongo glyphs, Nazca geoglyphs, and plasma configurations. It is also perhaps worth noting that there seem to be similarities among some of the decorations on walls, pillars, and artifacts from the Neolithic sites of Nevali Çori and Çatalhüyük in Turkey, the petroglyphs that Peratt and his group have studied, the rongorongo glyphs, and the plasma configurations Peratt has modeled (see Badisches Landesmuseum Karlsruhe 2007a, 2007b, for information on Nevali Çori, Çatalhüyük, and related sites).

A PLASMA CATACLYSM

Returning to the end of the last ice age, although there have been climatic fluctuations since, the last major global warming event occurred around 9700 BCE. I hypothesize a major plasma event occurred then, one that had dramatic, catastrophic, cataclysmic effects globally. Plasma hitting the surface of Earth could heat and fuse rock, incinerate flammable materials, melt ice caps, vaporize shallow bodies of water, and send the climate into a warming spell. The release of pressure that follows the melting of thousands-of-meters-thick ice sheets can induce earthquakes and even cause hot rock under pressure to melt and erupt to the surface as volcanoes. Interacting with the magnetic field and magnetosphere, this extreme plasma event may have even affected the rotation and axis of Earth. This plasma event, this solar outburst, is recorded by petroglyphs, geoglyphs, the rongorongo texts, and other artistic depictions around the world. (Admittedly, there may have been less dramatic plasma phenomena since 9700 BCE, which may have also been recorded. Some of our physical records may preserve oral traditions passed down over many generations or, like the rongorongo, may be copies of copies of copies . . . Peratt and his colleagues hypothesize three major episodes of auroral activity, each recorded in the rock art, between circa 10,000 BCE and 3000 BCE; see van der Sluijs and Peratt 2010, 42).

Many of the petroglyphs Peratt and colleagues have studied are undated, or doubtfully dated, but nonetheless clearly very ancient. While I was working on this book, a reader of my previous works alerted me to some particularly interesting petroglyphs located close to Adel in southern Oregon, near the borders with California and Nevada. Located on a basalt boulder near Greaser Canyon, the Greaser petroglyphs exhibit squiggles, rings, and odd lizard-like figures, all of which might represent super auroral displays and solar outbursts. Particularly interesting is the tentative date that has been suggested for these petroglyphs; they could possibly be up to twelve thousand years old (Volcanoguy 2007). That is, these petroglyphs could be contemporaneous with the plasma events that occurred during the end of the last ice age in circa 9700 BCE!

While attending a conference in Sedona, Arizona, in early October 2011 (at which I spoke about some of the subjects covered in this book), Katie and I had the opportunity to view some of the local ancient petroglyphs firsthand. As with the numerous petroglyph locations that Peratt and his group have studied, the

petroglyph site we visited had a southern field-of-view and the petroglyphs themselves showed many forms that seem to record auroral displays and plasma configurations in the skies. (Relative to the orientation of petroglyphs, interestingly Richard P. Erwin [1930, 39] long ago noticed that in Idaho petroglyphs typically occur on southern exposures, but he attributed this to the relative lack of lichens on southern exposures, which Erwin contended grew more commonly on northern exposures. I find Erwin's hypothesis for the orientation of petroglyphs less than fully convincing; rather his observations support the hypothesis that many petroglyphs record auroral and plasma displays.)

Solar activity over the last 11,450 years has been reconstructed in various manners, particularly using beryllium-10 (^{10}Be) and carbon-14 (^{14}C) isotope data from ice cores, sediment cores, and tree rings (Vonmoos *et al.* 2006). Among other factors, solar activity can be gauged based on sunspot numbers (higher numbers of sunspots correlate with higher solar activity), which in turn can be reconstructed for the past using isotope data (such as ^{14}C and ^{10}Be; see note at the end of appendix 5). Such studies show a number of minima and maxima in solar activity. Maxima occur, for instance (looking at the two millennia just after the end of the last ice age) at circa 9375 BCE (as far back as the data goes in the particular study), 8915 BCE, 8350 BCE, 8030 BCE, 7850 BCE, 7780 BCE, and 7660 BCE, while minima occur at 9165 BCE, 8215 BCE, and 7515 BCE (Usoskin *et al.* 2007). However, it is important to realize that a major plasma phenomenon, such as a large coronal mass ejection (CME) from the Sun, may not correlate with overall background solar activity. The 1859 Carrington Event occurred between the last solar minimum of circa 1680 and the current solar maximum, which dates to about 1960 and is ongoing. As plasma physicist Paul Kintner, of Cornell University, commented, "The Carrington event happened during a mediocre, ho-hum solar cycle. . . . It came out of nowhere, so we just don't know when something like that is going to happen again" (Kintner, quoted in Brooks 2009).

Plasma events apparently can occur over very short periods of time, probably measured in days, weeks, and months. Such short-term events may be extremely difficult to identify hundreds and thousands of years later using ^{14}C and ^{10}Be isotopes. Whereas even a large plasma event in the distant past might not be readily detected in the ^{14}C and ^{10}Be records, there is the possibility that it could

be picked up as a distinct nitrate spike. According to current theory, energetic particles associated with solar outbursts and CMEs increase atmospheric nitrate production, which is subsequently captured in ice cores. Ice cores dating back to 1561 show a series of nitrate events that correlate with solar events; the 1859 Carrington Event corresponds to the largest spike in the series (McCracken *et al.* 2001). In the deeper geological record, nitrate spikes also occur, such as major nitrate spikes during and after the end of the last ice age, including nitrate spikes that seem to bracket the Younger Dryas cold spell (circa 10,900 BCE to 9700 BCE) that preceded the final end of the last ice age and another major nitrate spike that may date to the middle or late ninth millennium BCE (Carlson 2010; Grootes *et al.* 1993; Mayewski *et al.* 1997; Melott *et al.* 2010). Nitrate spikes do not unambiguously indicate major plasma events, however; nitrate spikes are also associated with bolides such as comets, meteorites, and asteroids. The Younger Dryas may have been initiated by a comet impact or explosion in the atmosphere, producing an increase in nitrates and brought to an end by a large plasma event that also produced nitrates. To distinguish bolide-associated nitrates from plasma-associated nitrates, one may have to look to other markers, perhaps such as an iridium spike, which would be more readily associated with bolides than plasma.

Based on the data we currently have, I believe that both comet/bolide impacts/explosions and major plasma events have influenced human prehistory and history. The end of the last ice age was a time when I believe a major plasma event (or events) occurred on Earth, for which there is an increasing amount of evidence, including the nitrate data, the petroglyphs, rongorongo records, and the intentional burial of Göbekli Tepe.

Interestingly, Plato's chronology places the fall of Atlantis close to the end of the last ice age. In Plato's dialogue titled *Critias,* the lead character recounts:

Let me begin by observing first of all, that nine thousand was the sum of years which had elapsed since the war which was said to have taken place between those who dwelt outside the pillars of Heracles and all who dwelt within them; this war I am going to describe. Of the combatants on the one side, the city of Athens was reported to have been the leader and to have fought out the war; the combatants on the other side were commanded by the kings of Atlantis, which, as I was saying, was an island greater in extent than Libya and Asia, and when afterward sunk by an earthquake, became an impassable barrier of mud to

voyagers sailing from hence to any part of the ocean. (Plato, *Critias;* translated by Benjamin Jowett [1817–1893])

Here Critias is actually reporting what was told to Solon of Athens by an Egyptian priest in circa 600 BCE, so nine thousand years elapsed would place the fall of Atlantis at 9600 BCE, which is tantalizing close to the modern dating of the end of the last ice age. I am not suggesting that either Göbekli Tepe or the Great Sphinx is literally a vestige of Atlantis (although some people have claimed that the Sphinx and accompanying pyramids were constructed by survivors from Atlantis). However, could the 9700 BCE event have helped inspire the Atlantis legend?

The plasma event of 9700 BCE may have eradicated advanced civilizations and high cultures of the time (the mythic Garden of Eden and the very real builders of Göbekli Tepe come to mind), and radiation emanating from the plasma may have affected mental and psychical abilities. Perhaps this is the basis for a universal myth of a fall from a golden age, a time when humans lived in harmony and ease. Summarizing his survey of the concept of paradise and a golden age across cultures, Richard Heinberg (1989, 54–55) wrote that such a myth has been found "from Mesopotamia to Iran, Egypt, India, China, Australia, North and South America, and Africa. Everywhere, we have encountered essentially the same myth—the story of a primordial era when humanity and Nature enjoyed a condition of peace, happiness, and abundance."

With the coming of the plasma, everything changed. People cowered for their lives; they sought shelter in caves, under cliffs, in dwellings built of thick stone or carved into mountainsides. Was it because of plasma events that the Göbekli Tepe people buried their creation, arguably expending as much or more time and energy to carefully and purposefully cover over (and thus protect) the structures as they had to erect them in the first place? What is more, when Katie and I visited Göbekli Tepe we were surprised to see numerous iconographic similarities between it and Easter Island.

The outstanding feature of Easter Island is the moai, as I have described. In the case of Göbekli Tepe, stone pillars dominate the scene. Amazingly, both the moai and the anthropomorphic central pillars of Enclosure D at Göbekli Tepe have arms and hands positioned similarly against the body, with hands and fingers extended over the belly and navel region—as if pointing to or framing the belly button. The moai are looking up at the skies, and I believe the Göbekli Tepe pillars, which are anthropomorphic (humanoid in form), are also looking

toward the skies. Are they looking to identical phenomena? And then there is the Urfa Man (the life-sized statue of a man now housed in the Museum of anlıurfa). It has a similar iconography of the arms and hands, and noticeably absent is a well-defined mouth, a similarity it shares with the “female moai” carved of basalt and now housed in the museum on Easter Island. And what about the very names of Göbekli Tepe and a traditional name for Easter Island, Te Pito Te Henua? Both refer to the navel and can be interpreted as meaning “navel,” “birth,” “origins,” or “beginning”—perhaps the navel or beginning of the world, the beginning of time, or the beginning of civilization? I believe these similarities are real, but I might have missed them if I had not been to both sites in close succession.

Due to the plasma event, humankind was thrown into a dark age for thousands of years, only to reemerge, amidst megalithic monuments dating to a much earlier time, with nascent abilities and vague and scattered memories of what had happened. Some of those memories took physical shape in the megalithic architecture found around the world; what better way to attempt an escape from fierce skies than in a protective solid stone “fallout shelter”? On Easter Island there are numerous low stone “houses” with massive walls, and also the people often used the natural volcanic caves found on the island. Is this why? While most memories were vague, becoming little more than forebodings and legends of the fury of the gods against the ancestors, the rongorongo may precisely detail exactly what happened in the skies 11,700 years ago.

The rongorongo tablets may constitute the oldest surviving texts, thousands of years older than the Judeo-Christian Bible. Isolated on their tiny island, the Easter Islanders can be compared to medieval monks closely copying and recopying their treasured written archives. Maybe this is why, of all places, the detailed record survives on this remote little Pacific island. The sequences of the rongorongo glyphs may record the plasma configurations seen in the skies as they writhed and twisted, morphing from one form to another. These extremely accurate observations, meticulously recorded, may store valuable scientific information. I believe an important future task will be to assemble the surviving tablets, currently scattered among museums around the globe, and decipher the details of their message. This is not just an exercise in reconstructing the past, but also could be crucial to the survival of modern civilization. The rongorongo tablets may record not just the plasma configurations, but also information on

the first signs to expect, perhaps instabilities on the Sun's surface or subtle changes in the atmosphere, before a cataclysmic plasma outburst. Perhaps, as my wife Katie suggests, the rongorongo records a chronology of differing plasma intensities and associated electromagnetic currents. Astrophysicist Thomas Gold, in an offhand way, guessed that major plasma events might impact Earth approximately every ten thousand years. It has been 11,700 years since the last one; the next one could arrive at any moment! Let us fully understand what the ancients had to say to us—the warning and instructions they may have left for us—before it is too late.

Before we go too far with such a wonderful or outrageous (depending on one's inclination) theory involving major solar outbursts causing severe climate change, resulting in the end of the last ice age and devastation to high civilizations in remote antiquity, maybe we need to step back. Maybe we need a reality check. Can it actually be the case that our Sun is not the eternal, unchanging ball of fire in the sky that on a day-to-day basis we tend to take for granted? Who really doubts that tomorrow the Sun will rise once again, just as it did yesterday and the day before and the day before that . . . ? For many people the Sun is a stable fixture of their world. Well, looks can be deceiving. We need to explore the modern understanding of our Sun as well as the context of our Sun in the larger cosmos.

7

OUR NOT-SO-ETERNAL SUN

Despite popular misconceptions, the Sun is not a stable, unchanging, eternal ball of fire in the sky. Indeed, from an astrophysical and geological perspective, the Sun is quite the opposite. Fueled by nuclear fusion reactions, it is unstable, continually seething and churning, in disequilibrium, discharging not only visible light, but also a large energy array across the electromagnetic spectrum, and belting out charged particles as well. While the Sun may have little hiccups from time to time, it can also suffer from major bouts of coughing, spewing massive “solar storms” Earth’s way. Such storms, thousands of times more powerful than anything recorded in modern times, have left their marks in prehistoric records. It is inevitable that major solar storms will hit us again, and although there is no consensus as to exactly when, the evidence taken as a whole suggests that we are in for something major very soon—we may be overdue! And while experts may disagree on the details, it is clear that a major solar storm would have catastrophic consequences for our modern technological society.

SUNSPOTS

Some aspects of the Sun’s activities are more or less regular and therefore crudely predictable, whereas others still elude accurate prognostication. There are apparent cycles in the Sun’s activity, with various cycles taking place on timescales of decades, centuries, millennia, tens of millennia, and perhaps longer. And the truth is that we really do not understand the internal and external dynamics that drive these cycles. The Sun remains to this day a great unknown.

Perhaps the best-known solar cycle is that of sunspot activity. Sunspots are dark spots on the surface of the Sun, the largest of which can be visible to the suitably protected naked eye (that is, without telescopic magnification). Chinese sunspot observations date back to the fourth century BCE, and there were

isolated observations of sunspots in the West during medieval times, generally misinterpreted as planets transiting (crossing) in front of the Sun. It was not until the early seventeenth century that European astronomers systematically recorded sunspots; Galileo correctly understood that they are features on the surface of the Sun. Since the Sun rotates on its axis, sunspots appear to move across the face of the Sun. The Sun rotates once approximately every 25 days at the equator, but since the Sun is not solid, its rotation changes with latitude—at the solar poles it takes about 36 days for one rotation (Russell 2005).

Sunspots, which can be up to hundreds of thousands of kilometers in diameter and move across the surface of the Sun at hundreds of meters per second, are relatively cool spots (3,000–4,500°K) against the background surface temperature of the Sun (5,780°K). They are in large part a magnetic phenomenon, and there is intense magnetic activity surrounding sunspots. Although sunspots themselves are relatively cool features, the areas surrounding their margins are brighter and hotter than the average surface temperature, with the result that more sunspots correlate overall with a brighter and hotter Sun. During the period from about 1645 to 1715, known as the Maunder Minimum, few sunspots were observed, and this corresponds with the middle of the so-called Little Ice Age (late sixteenth century through early nineteenth century), a time of cooling on Earth.

Over a period of approximately eleven years the number of sunspots increases, reaches a maximum, and then diminishes again. This is apparently due to, or correlated with, the changing of the magnetic field of the Sun on a more or less twenty-two-year cycle, known as the Hale cycle (see Dooling 1998). The Sun’s magnetic field reaches peak strength during a solar sunspot minimum and reverses or flips in conjunction with the solar maximum, then flips back during the next solar sunspot cycle. Scientists have been keeping track of sunspot cycles since March 1755; Solar Cycle 24 began in December 2008. Over this time sunspot cycles have ranged in length from 9.0 to 13.7 years, and the maximum smoothed sunspot number (monthly number of sunspots averaged over a twelve-month period) has ranged from 48.7 (in the early nineteenth century) to 201.3 (during Solar Cycle 19, April 1954–October 1964). Another way of measuring sunspot activity is to measure the number of sunspot groups rather than the number of sunspots per se (Hoyt *et al.* 1994; Hoyt and Schatten 1998; Balmaceda *et al.* 2007; Clette *et al.* 2007; Vaquero 2007).

Two and one-half centuries of solar cycles is a very small sample. Fortunately an estimate of the number of sunspot groups, indicative of solar activity, can be reconstructed using fluctuations of isotopes ^{14}C and ^{10}Be recorded dendrochronologically (in tree rings) and in polar ice cores (the amount of ^{10}Be and ^{14}C in the atmosphere correlates inversely with solar activity). This has been done with considerable accuracy back to circa 9500 BCE (essentially the end of the last ice age; see Solanki *et al.* 2004, and Usoskin *et al.* 2007), and the results are rather startling; our Sun has been more active over the last few decades (since about the middle of the twentieth century) than it has been for thousands of years previously. Depending on how the data are interpreted (the translation of the isotope data related to solar activity is not straightforward, but requires various forms of analyses), the current overall level of solar activity is the highest it has been since about 9500 BCE to 9000 BCE, near the end of the last ice age!

In circa 9500 BCE the Sun was extremely active, with a record number of sunspots. Between 9500 BCE and about 8000 BCE the number of sunspots fluctuated widely, with record lows around 9200 BCE followed by extreme highs circa 9000 BCE to 8800 BCE. That is, solar activity showed wild fluctuations during this period and over the subsequent millennia, and until about 6000 BCE continued to exhibit wide discrepancies between high and low sunspot numbers, but the highs were less high. Relatively low highs continued until recent times, with the periods of circa 6000 BCE to 3500 BCE and circa 200 BCE to 1900 CE recording particularly low solar activity compared to the end of the last ice age. Then something happened in the twentieth century; the Sun started to become extremely active. Solanki *et al.* wrote, “According to our reconstruction, the level of solar activity during the past 70 years is exceptional, and the previous period of equally high activity occurred more than 8,000 years ago. We find that during the past 11,400 years the Sun spent only of the order of 10% of the time at a similarly high level of magnetic activity and almost all of the earlier high-activity periods were shorter than the present episode” (Solanki *et al.* 2004, 1084).

Indeed, based on the analysis of Ilya G. Usoskin *et al.* (2007, 303, fig. 3), the Sun’s activity today is higher than any time in the past since the period of 9500 BCE to 9000 BCE, just after the end of the last ice age. And remember that their

data do not go back further than circa 9500 BCE.

Comparing the record of solar activity with reconstructed records of climate change over the last twelve thousand years (and more), I believe there are definite correlations. The Younger Dryas ended with an abrupt warming spell at the end of the last ice age, roughly 11,400 to 11,700 years ago (depending on the calibration used; dated to circa 9700 BCE in Steffensen *et al.* 2008), and it is clear from the solar records that the Sun was extremely active around this time. Analyzing 11,700 years of ice core records from Kilimanjaro in eastern equatorial Africa, Thompson *et al.* (2002) report abrupt climate changes (involving in each case sharp drops in temperature, followed by sharp rises) at approximately 6300 BCE, 3200 BCE, and 2000 BCE. A prominent dust layer in the ice core, interpreted as signifying drought conditions, accompanies the 2000 BCE event; Thompson *et al.* (2002, 592) point out that a similar dust layer is found in approximately contemporaneous (dated to circa 2300 BCE) ice cores from Huascarán in the Andes of Northern Peru. These periods of abrupt and severe climate change occur in each case during periods of high solar activity, particularly the 3200 BCE and 2000 BCE events (see Usoskin *et al.* 2007, 303, figs. 3 and 4). The Kilimanjaro data also show an abrupt and dramatic warming, accompanied by a huge increase in dust, at the very beginning of the sequence, circa 9700 BCE; this corresponds to the end of the last ice age (Steffensen *et al.* 2008) and the dramatic events taking place then.

The solar activity data, the climatic data, the petroglyphs, the rongorongo texts, and the demise of the early civilizations at the end of the last ice age indicate that something mighty—something catastrophic—was happening. All of the evidence points to some sort of solar outburst or cosmic event wreaking terror on the surface of Earth. Today the Sun is starting to exhibit the same behavior as seen over ten thousand years ago, when catastrophe hit. Will we heed the warning signs? Will we take the lessons of the past seriously and prepare for the future?

Based on the data, James A. Marusek, a physicist and engineer who until his retirement worked for the U.S. Department of the Navy, argues that the Sun is currently undergoing a state change (Marusek 2010). That is, the inherently unstable Sun is readjusting and re-equilibrating, as it must do periodically through geological time. In an analogy, our own planet Earth has an internal dynamo and is constantly readjusting and re-equilibrating itself as heat is

released from the interior. This gives rise to earthquakes and volcanoes. Returning to our Sun, we may already have had a precursor of what is to come in the very near future, namely the solar storms of 1859, which I've previously mentioned.

There have been very recent (summer 2011; see Space Ref 2011; and Southwest Research Institute 2011) reports that the Sun is showing signs of going into a period of low numbers of sunspots when just the opposite had been expected. It has been suggested that the Sun is potentially entering a sort of hibernation or calm period, and this may even impact Earth by cooling the climate, not unlike the 1645 to 1715 Maunder Minimum, which corresponded to the Little Ice Age. It is not clear if this is really the case, but even if it is, it does not preclude the possibility there could be some very unusual activity of the Sun on the other extreme; that is, during a period of relative dormancy or hibernation there could be an incredible solar outburst. At the end of the ice age some twelve thousand years ago there were wild fluctuations in sunspot activity, wide swings between highs and lows, and it seems that during periods of low sunspot activity the energy builds up and erupts as massive solar outbursts rather than being given off as more numerous and smaller flares and CMEs. The 1859 Carrington Event occurred during the overall "quiet" Solar Cycle 10, and the May 1921 massive solar storm occurred during the overall rather average Solar Cycle 15. Perhaps, being a geologist, I like the analogy of a major active tectonic/earthquake zone where stress is building up. The stress and energy can be relieved either by many smaller earthquakes in succession over time, or the stress and energy can build up and continue to build up until they are finally released as one or a few major earthquakes (and the accompanying foreshocks and aftershocks). (Smaller earthquakes can still be substantial from a human perspective; for example, it takes about thirty-two magnitude 6 earthquakes to equal the energy released by one magnitude 7 earthquake.) A short-term lull in sunspot activity says to me that energy is building up in the Sun and will be released, probably sooner rather than later, in one or a few massive outbursts. My conclusion is that we better be prepared!

Something else worth noting is a point made by Espen Gaarder Haug (2010), namely that most people are woefully unaware, unprepared, or simply willfully and purposefully ignorant of so-called low-probability, yet high-impact, events such as natural disasters like major hurricanes, tornadoes, tsunamis, volcanic

eruptions, or extreme solar outbursts. These are sometimes referred to as Black Swan events. Exacerbating the situation, many people, whether economists, politicians, or even scientists, use the wrong types of mathematical models in analyzing events and planning for the future. In particular, analysts use Gaussian models, fitting or modeling data to the theoretical bell curve or normal distribution. However, compared to Gaussian models, many real world phenomena have higher peaks and fatter tails than are seen on a theoretical normal distribution. This means that the models underestimate the probability of large changes, whether they are price swings in financial markets or variations in solar activity (which Haug has analyzed). With respect to the Sun specifically, Haug concluded, "Sudden expected large changes in solar activity are much more likely to happen than any type of Gaussian model would assume . . . the risk is somewhat similar to massive stock market crashes and recessions; most people including politicians tend to underestimate the probability for them to occur. In short, many people, including people deeply involved in planning and preparedness for disasters, seem to have a Gaussian type of thinking. They do not appreciate the Black Swan phenomenon" (Haug 2010, 10).

As Haug points out, the historical record of solar storms is incredibly short and not at all representative. He wrote, "However, as we know from our discussion of the shortcomings of the Gaussian, the concept that there probably have been and will continue to be more powerful solar storms than [the 1859 Carrington Event] . . . is exactly what we should expect. What is the likelihood that the written record of solar storms over a few hundred years would detect the maximum solar storms for a sun that has been shining for billions of years? Close to zero" (Haug 2010, 10).

It was the astronomer John A. Eddy who, in 1976 (see Brody 2002, 147–49, for a historical perspective), ultimately convinced the scientific community of the reality of the Maunder Minimum (the relative lack of solar activity, as seen by the anomalous absence of sunspots, from about 1645 to 1715). Historically there was a long tradition, going back to Aristotle and before, that the Sun is perfect, unchanging, and eternal. Old ideas are often difficult to overturn, no matter how wrong the ideas may be. People are resistant to changing their fundamental beliefs. Eddy ends his seminal paper on the Maunder Minimum with the following words: "The reality of the Maunder Minimum and its implications of basic solar change may be but one more defeat in our long and

losing battle to keep the sun perfect, or, if not perfect, constant, and if inconstant, regular. Why we think the sun should be any of these when other stars are not is more a question for social than for physical science" (Eddy 1976, 1200).

That is, all the evidence indicates that over time our Sun, like any other star, is extremely irregular, varying in intensity and activity. During the last ten thousand years or so, and especially during the last few thousand years, the Sun has been relatively stable overall (despite some minor fluctuations), and this has been a time when civilization arose—or re-arose—and flourished. But if we look at the longer prehistoric record we soon learn that the Sun has had tremendous mood swings, and there is every reason to believe that another such swing, resulting in cataclysmic solar storms, could be imminent.

EARTH'S MAGNETOSPHERE

The Earth's magnetosphere has been called "Our Shield in Space" (NASA 1981), and indeed it helps protect Earth from the constant incoming barrage of particles from outer space, generally referred to as cosmic rays, which include plasma (charged particles) originating from our Sun (the solar wind), incoming particles from elsewhere in our galaxy, and particles from the universe in general. The magneto sphere of Earth is formed by the interaction between charged particles, particularly those composing the solar wind, and the magnetic field of Earth, which originates deep in the planet's core. The charged particles are deflected and flow, generating electric and magnetic currents that determine the configuration of the magnetosphere. The dynamics of the magnetosphere are very complex and continually change with variations in Earth's magnetic field, the solar wind, the heliosphere, the interplanetary magnetic field, the intensity of incoming cosmic rays, and so forth.

The magnetic poles of Earth do not correspond to the geographic poles, but are currently off by about 11°. They also vary in their locations over time—in recent years the north magnetic pole has been migrating north-northwest at a rate of about 55 kilometers per year, whereas at other times it has stayed in approximately the same location for a number of years (Russell 2007; Geological Survey of Canada 2008; National Geophysical Data Center 2012). Sometimes Earth's magnetosphere is simplistically visualized as symmetrically positioned lines of force emanating from magnetic pole to magnetic pole, similar

to a huge bar magnet, but this is incorrect. Earth's magnetosphere is blown and distorted, primarily by the solar wind, into what has been variously described as a teardrop shape or a bullet shape (with a blunt nose and elongated cylinder-like structure extending out into space). Facing the Sun ("upwind" toward the Sun), the magnetosphere is compressed and typically extends out for about sixty-five thousand to ninety thousand kilometers from Earth's surface, whereas the magnetotail (extending away from the Sun) can extend well over one million kilometers. The overall "cylinder" shape of the tail is estimated at around 250,000 to 300,000 kilometers in diameter (in comparison, the average diameter of Earth is 12,742 kilometers).

Earth's magnetosphere includes the Van Allen radiation belts, discovered by James Van Allen and his colleagues based on data from the first American satellite mission in 1958. These consist of belts or layers of energetic charged particles (plasma) that are held in place by Earth's magnetic field. Two major belts have been distinguished: an inner belt extending from about one hundred to ten thousand kilometers above the Earth's surface and an outer belt extending about thirteen thousand to sixty thousand kilometers above the surface. Interestingly, a thin band of antimatter (specifically antiprotons) is trapped between the inner and outer Van Allen belts (Adriani *et al.* 2011).

The upper portion of our atmosphere, referred to as the ionosphere because it contains ionized (electrically charged) particles, forms the inner boundary of the magnetosphere. Composed of various layers and distinguished by changes in ionization and electromagnetic properties, the ionosphere extends from about sixty kilometers to over five hundred kilometers (in some models and classifications, over one thousand kilometers) above Earth's surface. The ionosphere is of practical importance in the modern world because, among other things, it exerts an influence on radio wave propagation over long distances (high-frequency/short-wavelength radio waves can be bounced off of the ionosphere). Schumann resonances are extremely low-frequency electromagnetic radiation global resonance phenomena that propagate through the cavity formed between the surface of Earth and the ionosphere.

The auroras, the northern and southern lights (aurora borealis and aurora australis), occur in the ionosphere when photons (light particles) are given off by atoms going from an ionized or excited state to a ground state. Different types of

atoms changing state, and how much energy is absorbed and subsequently released, cause different auroral colors. Thus, colors in the green range (including yellowish-greens), as well as some brownish-red colors, are attributed to emissions from oxygen atoms, while various blues and reds (and together they may form purples) are due to the emissions of nitrogen atoms. The atoms are excited by collisions as particles are trapped and funneled along the magnetosphere toward Earth's magnetic poles; they subsequently lose energy and give off the light observed as auroral lights. Auroras are primarily due to the solar wind, the stream of particles flowing in from the Sun. Under normal conditions, the auroras are seen along rings around the magnetic poles of Earth; these rings are typically located somewhere in the region of about 10° to 20° from the magnetic poles. During intense solar winds, solar outbursts, and coronal mass ejections (the corona is the outermost layer of the Sun, consisting of plasma, with a temperature measured in the millions of degrees; Mattson 2010) the auroras increase in intensity and are seen at lower latitudes as the aurora zone expands.

A SOLAR PROTON EVENT AT THE END OF THE LAST ICE AGE

Paul LaViolette (2011a) has marshaled evidence that a major solar flare accompanied by a super solar proton event (SPE), or events, at the end of the last ice age "fried the Earth" (to use the description of LaViolette's hypothesis put forth in the popular *Space Daily;* see *Space Daily* 2011). During an SPE, protons are accelerated to incredibly high energy levels and penetrate into our atmosphere. (Note: solar proton events are also commonly referred to as solar particle events, and in both cases the acronym SPE is used for such an event; indeed, whatever moniker is applied, most of the particles ejected by the Sun in such an event are protons.)

LaViolette bases his conclusions on meticulous analyses of radiocarbon concentrations in sediment cores from the Cariaco Basin (off the coast of Venezuela) correlated with acidity spikes, high nitrate ion concentrations, and changes in ^{10}Be deposition rates in the Greenland ice record, all of which he argues are indicators of a sudden cosmic ray influx, in turn correlating with solar activity as expressed specifically through solar flares and SPEs. Additionally, there would also have been accompanying CMEs on an enormous scale. LaViolette dates the event, which is the major focus of his 2011 *Radiocarbon* paper, to "12,837 +/ 10 cal [calendar] years BP [before the present]" (LaViolette

2011a, 1) and equates it with major faunal extinctions in North America at this time. This is approximately (or possibly exactly; see appendix 3) the start of the Younger Dryas, for which I am adopting a date of circa 10,900 BCE. In a footnote to his paper LaViolette (2011a, 17) notes that the same type of pattern is seen in the sediment and ice data at the end of the Younger Dryas (i.e., the very end of the last ice age). LaViolette dates this terminal ice age event to "11,571 cal yrs BP," which corresponds closely to the approximately 9700 BCE date derived by Steffensen *et al.* (2008) for the end of the last ice age. To quote LaViolette directly relative to this event, "This suggests that an overly active Sun may have played a significant role also in causing abrupt climatic change at the end of the ice age" (LaViolette 2011a, 17, footnote).

In his paper LaViolette discusses some of the effects of a massive SPE and the attendant solar activity for the Earth. The ozone layer, our protection from deadly ultraviolet (UV) rays, would have been greatly depleted, with major ozone holes forming in some areas, that is, if the ozone layer had not been destroyed completely! Increased doses of damaging, and potentially lethal, UV radiation could have posed a major hazard for organisms on Earth, especially in high and middle latitudes. Besides the increased UV radiation, high-energy cosmic rays that are part of a major SPE would penetrate the atmosphere and raise radiation levels on the ground. According to LaViolette's calculations, unprotected organisms at sea level during the event of "12,837 cal yrs BP," which is the focus of his paper, could have accumulated radiation doses of 3 to 6 Sieverts (a unit of radiation exposure, 1 Sievert = 100 rems [an older unit of radiation doses]) over a period of two or three days. Lethal radiation doses for humans are in the range of about 3.5 Sieverts, and for many large mammals in the 3-to 8-Sievert range. The best mode of protection at the time, both from the UV radiation and the cosmic ray radiation, may have been to seek safety in caves and other underground shelters (*Space Daily* 2011; LaViolette 2005).

Interestingly, Austrian archaeologist and speleologist Heinrich Kusch and his wife Ingrid Kusch have documented hundreds upon hundreds of tunnel systems under Neolithic settlements found throughout Europe and Turkey, some dating back to around twelve thousand years ago (Kusch and Kusch 2011). According to Heinrich Kusch, based on the number of tunnels that have survived to the present day, the original extent of such tunnels must have been absolutely enormous! According to him, many of the tunnels "are not much larger than big

wormholes—just 70 cm wide—just wide enough for a person to wriggle along but nothing else. They are interspersed with nooks, at some places it's larger and there is seating, or storage chambers and rooms. Taken together it is a massive underground network" (Heinrich Kusch, quoted in *Austrian Times* 2011; see also *Daily Mail* 2011).

An immediate question is why were these tunnels built? What was their use? An incredible amount of time and effort went into their construction, and so their purpose could not have been trivial. To quote Heinrich Kusch, "The precision with which they were built in prehistoric times is unbelievable. Miners and tunnel construction engineers I spoke with were stunned. . . . It would be hard to dig tunnels as these even with today's means. They are hewn very exactly in the hardest granite and people most probably didn't even have metal when the tunnels were built" (Heinrich Kusch, quoted in *Austrian Times* 2011).

It has been suggested that perhaps these tunnels were used by early humans to escape predators or enemies, or perhaps they served as underground passages from one place to another (*Austrian Times* 2011). I suggest that the tunnels were primarily built as safe havens and refuges from catastrophes occurring on the surface of Earth. These might have included meteor bombardments (see Schoch with McNally 2003), but in particular I believe the tunnels provided shelter from major solar outbursts (including CMEs and SPEs). In my opinion, the fact that such events were occurring around twelve thousand years ago, the very time when many of the tunnels were carved, is not simple coincidence. Also, I speculate that many artificial caves and tunnels that have been dated to later periods (such as the Bronze Age, circa 3300 BCE to 1200 BCE) by archaeologists may have their origins much earlier, at the end of the last ice age some twelve thousand years ago.

LaViolette (2011a) also determined that an enormous SPE would significantly disturb the geomagnetic field of Earth and induce a partial (or possibly complete, at least for a short period of time) collapse of the magnetosphere. Earth is surrounded by a dust cloud, composed of interplanetary debris plus particles that the solar wind blows off the surface of the Moon. These dust particles can acquire electrical charges by interaction with electrons in the interplanetary plasma, by photoionization due to the solar UV radiation, and by other means. The charged particles (including particles of antimatter, as we have

seen) are trapped in the magnetosphere, held and essentially protected there. But with a partial or complete collapse of the magnetosphere, cosmic rays, SPEs, and CMEs could heat the particles up, causing them to melt, and subsequently they would resolidify, forming spherules. Furthermore, dust particles and spherules could be jettisoned into the atmosphere and eventually fall to the surface of Earth. Thus, according to the hypothesis regarding solar flares, SPEs, and CMEs at the end of the last ice age, a layer or layers of extraterrestrial debris should be found at some geological and archaeological sites dating to this period.

LaViolette points out that layers of extraterrestrial debris, including nanodiamonds (as have been reported in some layers dating to the end of the last ice age; see appendix 5), do not necessarily imply that a comet, meteorite, or asteroid either hit Earth or exploded in the atmosphere. Furthermore, by the SPE hypothesis, it is expected that the extraterrestrial dust layer would accumulate on some parts of Earth more than on others, and in some places there might be no accumulation of extraterrestrial debris at all. This is due to the fact that the solar proton flux and debris cloud, interacting with Earth's magnetosphere, would be irregular with large spatial variations. Indeed, the data indicate that accumulations of extraterrestrial debris at the end of the last ice age show just this pattern, which has led some scientists to call foul and question the integrity and reliability of their colleagues' work when evidence for extraterrestrial debris at the end of the last ice age was reported by one group, but another group at a different location could not replicate the results. By the SPE scenario, a pattern of such debris in some places but not in other areas is what is to be expected!

I believe that LaViolette (2011a) puts together a very powerful and compelling argument that our Sun was much more active, by orders of magnitude, at the end of the last ice age. The core of LaViolette's meticulous work is that our Sun is not stable, but goes through periods of major instability and increased activity (whatever the cause of such instability and increased activity may be), and the last major (there have been ups and downs since then) occurrence of such increased solar activity was at the end of the last ice age; that is, unless we are willing to acknowledge that the Sun is ramping up right now and again going into a period of instability and increased activity after a lull of over ten thousand years.

8

COSMOCLIMATOLOGY

In recent years there has been increasing evidence for, and acknowledgment of, connections between climate, Earth's magnetic field, solar activity, and related extraterrestrial and other "subtle" factors (Courtillot *et al.* 2007; Mackey 2007). Much of this work goes against the reigning paradigm, the common consensus that has solidified around the topic of global climate change (more commonly referred to as global warming). The general consensus view, for instance, has been that increases in global temperatures seen in the twentieth and twenty-first centuries have been due primarily or totally to the actions of humans, most notably the increase of greenhouse gases (such as carbon dioxide) in the atmosphere due to the burning of fossil fuels and deforestation. Natural factors and cycles have been downplayed or ignored, despite the fact that changes in greenhouse gases have been correlated with global temperature changes for hundreds of thousands—even millions—of years, long before humans could conceivably have been causing such changes. Indeed, increases in carbon dioxide may in part be a consequence of global warming rather than a cause (Ferreyra 2011). Increases in temperature due to other factors (such as increases in solar activity) may warm the oceans, for instance, resulting in the release of carbon dioxide and an inability to absorb more carbon dioxide; once the carbon dioxide is in the atmosphere, it may further reinforce global warming. This of course does not necessarily totally negate the contribution that human-released greenhouse gases may make to global warming, but it may put such factors into perspective.

PROTECTING THE PARADIGM

Following the reigning paradigm that the major portion of global warming observed over the last century is due to human actions, the Intergovernmental

Panel on Climate Change (IPCC; see discussion in Mackey 2007) and like-minded scientists (see, for instance, Pittock 2009) have taken the position that even if there might be a link between solar variability and climate, the effects would be so negligible (particularly as compared to human-induced climate change) as to be insignificant from a pragmatic point of view, and therefore any such link can be dismissed or ignored for all practical purposes. Indeed, the critics of solar variability as an explanation, partial or complete, of climatic change on Earth have charged that solar variability research may have political motivations. The well-known solar variability skeptic Barrie Pittock asserts, "Solar influences might be suggested as an alternative explanation of climatic change because that might undermine some unwelcome hypothesis such as that recent climate variations are due to human emissions of greenhouse gases" (Pittock 2009, 486).

Of course, the opposite may be readily the case also; solar (and other, for that matter) influences might be dismissed as too insignificant to be an alternative explanation for climate change, as that might inconveniently undermine the current politically correct notion that significant climate change is due to human causes. After all, former United States Vice President Al Gore and the IPCC were awarded the 2007 Nobel Peace Prize for their work establishing and publicizing the link between human activities and climate change. As a case in point, at the CERN (European Organization for Nuclear Research, formerly called Conseil Européen pour la Recherche Nucléaire) labs in Geneva, the CLOUD (Cosmics Leaving Outdoor Droplets) experiment is examining the role particles from space, such as cosmic rays, may play in cloud formation, which in turn affects weather and climate. CERN Director General Rolf-Dieter Heuer has told the scientists who are involved with the experiments not to draw conslusions from their results! Heuer is quoted as saying, "I have asked the colleagues to present the results clearly, but not to interpret them. That would go immediately into the highly political arena of the climate change debate. One has to make clear that cosmic radiation is only one of many parameters" (Heuer, quoted in Calder 2011; see also Orlowski 2011).

In this quotation Heuer is apparently referring to the work and theories of Henrik Svensmark, director of the Center for Sun-Climate Research at the Danish National Space Center. Much of Svensmark's work has focused on how cosmic rays can affect the formation of clouds and thus in turn have a large

impact on Earth's climate (see further discussion below).

In a review article of work along these lines, Svensmark writes, "During the past 10 years, considerations of the galactic and solar influence on climate have progressed so far, and have found such widespread applications, that one can begin to speak of a new paradigm of climate change. I call it cosmoclimatology and . . . I suggest that it is already at least as secure, scientifically speaking, as the prevailing paradigm of forcing by variable greenhouse gases. It has withstood many attempts to refute it and now has a grounding in experimental evidence for a mechanism by which cosmic rays can affect cloud cover" (Svensmark 2007, 1.18). In other words, cosmoclimatology challenges the status quo, politically correct, consensus view that global warming is due primarily or solely to modern human activities.

Science journalist and commentator Nigel Calder opines, "CERN has joined a long line of lesser institutions obliged to remain politically correct about the man-made global warming hypothesis. It's OK to enter 'the highly political arena of the climate change debate' provided your results endorse man-made warming, but not if they support Svensmark's heresy that the Sun alters the climate by influencing the cosmic ray influx and cloud formation. . . . The once illustrious CERN laboratory ceases to be a truly scientific institute when its Director General forbids its physicists and visiting experimenters to draw the obvious scientific conclusions from their results" (Calder 2011).

Unfortunately, the case of CERN and the unpopularity in some circles of Svensmark's research are not isolated incidents in science. Indeed, such attitudes have meant that antiparadigm analyses were, and are, often given short shrift or dismissed out of hand by many in the mainstream scientific community. (This community, of course, is composed predominantly of specialists in other fields. Just because someone is a scientist, that does not mean that he or she is in a position to properly judge conclusions outside of his or her area of expertise). The social institutions of modern science reinforce these attitudes and actions. As pointed out decades ago by Thomas Kuhn (1962), scientists beholden to a reigning paradigm downplay, belittle, or simply ignore other theories, approaches, and points of view. To give a specific modern example, in cellular biology the theoretical model of a sodium-potassium pump (also known as the membrane pump theory) is almost universally accepted as the mechanism used by cells to maintain the proper levels of sodium and potassium in their interior

environments. Yet, as reviewed by L. Edelmann (2005), a mass of experimental data and theoretical calculations indicate that the sodium-potassium pump theory is flawed and that, indeed, better models, models that fit the data more precisely, have been developed. (One model, developed by Gilbert Ling and summarized by Edelmann [2005], is known as the association-induction hypothesis. Martin Chaplin has developed another model, discussed by Bennett Daviss [2004]. The details of the competing models are not important to our present discussion.)

If there is a better model, one that fits the data more accurately, how can it not be accepted by "objective" scientists? The fact is that the objectivity of science, or at least of the practitioners—the scientists—is a myth. Scientists, individually and collectively, have vested interests, be those interests personal prestige, monetary rewards (grants, salaries), defending their "intellectual turf " and pet theories, or other considerations (see appendix 2). The modern institutions of science serve primarily to reinforce the status quo, the mainstream thinking, the conventional wisdom of the time. Publication in high-status scientific journals is the way for the typical scientist to advance her or his career. Submissions to such journals are subjected to the peer review system. The reviewers act as censors, generally guarding the status quo and rejecting any work that differs too radically from their own work and ideas or that of their conventional colleagues. There has been much discussion concerning the flaws of the peer review system (see Edelmann 2005), and in the United Kingdom the members of parliament have even taken an interest in these issues. As stated in a BBC News article concerning the report of the House of Commons Science and Technology Committee (2011) on peer review in scientific publications, "'Peer-reviewed' has become a byword for 'scientifically sound and approved,' but complaints have arisen in recent years that the process can sometimes work to suppress radical new ideas, and can fail to catch fraudulent research" (Boettcher 2011).

Not only is peer review commonly used to determine which articles are published, it is also used to determine who receives scientific grants, which projects are funded, if and when scientists are hired and promoted, and so on.

There are other powerful factors beyond the peer review system that reinforce the status quo. As honor and prestige are heaped on those advocating particular hypotheses, theories, and paradigms, competing theories are further marginalized. Returning to the case of the sodium-potassium pump, once Jens

Christian Skou was awarded a portion of the 1997 Nobel Prize in Chemistry for the discovery of Na/K-ATPase (an enzyme equated with the sodium-potassium pump), it became virtually impossible to question the reigning dogma or present contradictory evidence and alternative theories. Likewise, the 2007 Nobel Peace Prize was awarded to the promoters of the human-induced global warming hypothesis. As L. Edelmann aptly states, “Awarding Nobel Prizes becomes an act of canonizing ideas and hypotheses into fully-fledged sacrosanct theories” (Edelmann 2005, 727).

The religious imagery and analogy here are quite fitting. The accepted paradigm, the scientific dogma, is not to be fundamentally questioned. Small additions and tweaking, elaborations and expansions, and building on the accepted paradigm are acceptable and even encouraged, but questioning the fundamental basis of the paradigm is not allowable. Radically dissenting views and any data that challenge the accepted paradigm must be suppressed. Heretics are persecuted or ignored. (In past centuries, this might mean torture or death. In modern times it might mean exclusion from the scientific community by being locked out of jobs, publication outlets, and grant funding.) Ultimately such tactics constitute “cheating by concealment” and “discreet fraud,” to apply the terms of Edelmann (2005).

Galileo Galilei (1564–1642) was prosecuted and convicted by the Inquisition for his heliocentric worldview (that the Sun is the center of the solar system and Earth orbits around the Sun). Of course, at the time a geocentric worldview (Earth is at the center, with the Sun, Moon, planets, and stars all revolving around Earth) was the reigning paradigm. As an example of “cheating by concealment” and “discreet fraud,” Edelmann points out that in Galileo’s time, “All the reasons proving the earth is at the centre of the universe would be referenced in a [status quo, mainstream] review, epicycles of certain planets would not be mentioned at all, or, at the very best, as marginal problems. A heliocentric worldview—favoured by a (known) minority—which can easily explain these epicycles, would not show up in this review . . . this would constitute an obvious fraud” (Edelmann 2005, 727).

But that was the seventeenth century. Surely such scientific fraud would not take place today, four hundred years later! Using the example of the sodium-potassium pump, Edelmann points out that such fraud is very much with us to this day. “Extensive reviews about this pump have been released without

mentioning published experiments that falsify the pump idea and without acknowledging that phenomena attributed to the pump cannot only be explained without the assumption of an energy consuming pump, but that they can be predicted directly within the framework of AIH [association-induction hypothesis]. Experimental results, which could foster doubts about the truthfulness of MPT [membrane pump theory], are not only left out of many reviews, but they are also left out of more detailed textbooks of cellular biology" (Edelmann 2005, 727).

This is a particularly insidious form of fraud, one that is self-perpetuating as a new generation of scientists, learning from reviews and textbooks, is never even exposed to the anomalous data, data that question the accepted paradigm, and alternative hypotheses and theories are ignored. In such a context it is difficult to even be aware that another viewpoint is possible, and this is exactly as intended by the guardians of the status quo! One wonders how much material of high scientific merit, hidden in the obscure recesses of little-known and low-status publications or never published at all, is being covered up by status quo mainstream scientists promoting their own agendas and following their own deep subconscious beliefs and obsessions, which may effectively amount to a religion.

As Edelmann notes, "Obsessed with the overvalued idea that the solution to a scientific problem . . . is to be found within the framework of the accepted paradigm . . . , an alternative paradigm is *a priori* rejected" (Edelmann 2005, 728, italics in the original).

Nothing has changed, it seems, since Galileo's time.

Interestingly, however (and maybe there is some hope here), it does not take a majority to sway the masses, whether they make up the collective scientific body or the public at large. A study carried out at Rensselaer Polytechnic Institute (see Xie *et al.* 2011) indicates that when 10 percent of a population holds strongly and unshakably a certain belief, this belief will be adopted by the majority. Thus, to gain widespread acceptance for an idea actually only requires convincing 10 percent of the group under concern (such as the community of scientists). But of course this is a double-edged sword. The initial 10 percent (with the majority following in its wake) may be convinced of an idea

independent of whether that idea is valid or not. Ultimately science is not democratic; that is, the fact that a majority holds a certain belief (whether a majority of scientists or a majority of the general public) does not guarantee that the idea is valid or true. Indeed, one can argue that history says quite the opposite; the geocentric worldview, now discarded, is but one famous example.

A NEW PARADIGM: COSMOCLIMATOLOGY

Returning to the science of climate change on Earth, an important fact is that the Sun is not literally at the center of our solar system, with all of the other planets revolving around the Sun. Yes, in a general sense the Sun is in the center with everything else going around it, but the Sun itself is moving in an orbit around the center of mass of the solar system (known as the barycenter). The diameter of the Sun is about 1.4 million kilometers, and it moves around the barycenter within a circle that has a diameter of a little over two solar diameters. The orbital path of the Sun is not even close to a simple circle or ellipse (as are the planetary orbits), but due to the gravitational and tidal influences of the planets, the Sun's orbit takes the form of an epitrochoid (Mackey 2007, 956), that is, a larger circle that is connected to a small circle or ring nested within it on one side. Another way of describing this is that the Sun is, for most of any one orbit, following a large and nearly circular path, but then its orbit tightens into a smaller radius, goes backward relative to its previous direction (referred to as a kind of retrograde motion), completes a loop, and then heads forward again along the larger circular path. It is believed that no alignment of the Sun and all of the planets (plus asteroids, comets, and other objects in the solar system, for that matter) is ever exactly and precisely the same, and therefore no two epitrochoid-shaped orbits of the Sun are exactly the same.

There is an apparent periodicity in the orbit of the Sun along the epitrochoid path (Perryman and Schulze-Hartung 2010), corresponding to eight distinct patterns of such epitrochoid orbits, each of which takes about 179 years for the Sun to complete; this periodicity in turn apparently corresponds to periodicities in planetary positions around the Sun (Mackey 2007). The Sun's motion significantly affects its internal dynamics and activity. The Sun is not internally homogeneous nor is it truly spherical (it has an oblate spheroid shape); portions of the Sun are solid-like (the core), much is fluid-like, and the rest is gaseous. Furthermore, the internal aspects of each portion or layer of the Sun are "lumpy" rather than homogeneous. Its motions affect differentially its various portions,

and the Sun on its orbit travels through its own electromagnetic fields to varying degrees at different times. It has been suggested that these motions may correlate with the Sun's eleven-year sunspot cycle, the twenty-two-year Hale cycle (during which the Sun's magnetic dipole undergoes an inversion cycle, back and forth), and longer-term periodicities and trends in solar activity (see review in Perryman and Schulze-Hartung 2010). In particular, during the time when the Sun is following the path of the small retrograde loop-theloop in its epitrochoid orbit it can be characterized as in a chaotic phase and as generally less active or relatively dormant, and when it is on the larger radius forming a nearly circular path it is in an ordered phase and relatively more active. The Maunder Minimum, a time of relatively few sunspots and cooler climates, has been correlated with a time when the Sun was on the small loop of its orbit (Mackey 2007, 958).

What this means is that there is interplay between the Sun and the planets, and indeed all of the components of the solar system. The Sun's activity affects the planets (including Earth), but the planets also affect the Sun. How much each planet contributes overall to affecting the Sun, however, remains an open question. On the one hand the massive outer planets, Jupiter and Saturn, are important components of the collective gravitational effect the planets have on the Sun, but on the other hand, although much smaller and less massive, the closer inner planets (Mercury, Venus, Earth, and Mars) can have significant effects too. In his book *Apocalypse 2012* Lawrence E. Joseph (2008, 111) quotes independent researcher and author Richard Michael Pasichnyk as stating, "The Earth's magnetic field undergoes changes of intensity that reflect the magnitude of changes in solar activity *before* they take place on the Sun . . . magnetic data for the Earth at sunspot minimum indicates the 'depth' of the following maximum" (italics in the original statement by Pasichnyk). If this is true, it suggests that Earth's magnetic field influences the Sun, as well as vice versa. However, I have not been able to confirm that this is the case. At any rate, solar activity certainly influences, or at the least is correlated with, geomagnetic activity.

Vincent Courtillot and colleagues (Courtillot *et al.* 2007) analyzed solar irradiance (electromagnetic radiation from the Sun in all its forms), several different geomagnetic indices, and global temperatures over the twentieth century. They found a strong correlation among all of these factors; however,

beginning in the middle 1980s climate (global temperature) deviates from the tight correlation with all of the other factors. These authors write:

> We view the fact that the long-term "overall magnetic trend" is essentially common to all these [magnetic] indices . . . as evidence that the entire system of ionospheric and magnetospheric currents, despite all their complexity, pulses in rough unison with the Sun on a decadal scale (and that this also applies to the main spectral components of total solar irradiance—i.e. photons—and also to the solar wind—i.e., particles). None of this was a priori obvious. Note that magnetic variations revealed by the new indices, which reflect precisely the changes in the UV-X [ultraviolet] component of the irradiance, are a far more sensitive indicator (by several orders of magnitude!) than the total solar irradiance which varies by only ~1‰ [approximately one part per thousand, or a tenth of one percent].
>
> If solar activity is correlated to climate over much of historical times, it might be expected that the "overall magnetic trend" would correlate with the recent evolution of global temperature, and this is indeed the case up to the mid-1980s, but not since then. . . . Of course, the relation . . . [in] this case does not imply a causal link from Earth's magnetism toward climate, but from the Sun to both climate and magnetic changes. Clearly, 100 yr is not enough to ascertain that such a correlation is robust, but it is as impressive as many of the correlations of time series proposed over this time range. (Courtillot *et al.* 2007, 331–32)

After the middle 1980s the global temperature diverges, increasingly dramatically, from the indices for solar radiation and geomagnetic strength and variation. This anomalous climate change may be genuinely caused by human activities, such as the increase of greenhouse gases. Greenhouse gases have been increasing for over a century, and it may only be as of the middle 1980s that they have begun to overpower (perhaps only temporarily) other factors; the truth, however, is that we do not know for certain.

Those who argue against, or simply dismiss, a correlation between solar variations and climate claim that in order for such correlations "to be convincing a linking physical explanation or mechanism is needed" (Pittock 2009, 485). This is actually a bogus argument; if the correlations hold up to scrutiny, they should be taken at face value and possible mechanisms can be explored. This is the approach that Courtillot *et al.* (2007) take. They discuss three major

mechanisms by which changes in solar activity could affect climate: (1) changes in the amount of radiation given off by the Sun, which ultimately change the heat input to the lower atmosphere, leading to climate change; (2) changes in solar UV radiation that can cause changes in the stratospheric ozone layer, affecting the temperature of the stratosphere; and (3) changes in the concentration of galactic cosmic rays (GCRs; cosmic rays from our galaxy, but from beyond our solar system) impacting the Earth. GCR input to the Earth is controlled or modulated by the Sun's magnetic activity and the Earth's magnetic field (which in turn is affected by solar magnetic activity). This third mechanism appears to be the most significant of the three.

Cosmic rays may act on Earth's climate by affecting cloud cover, creating cloud condensation nuclei and thus more clouds, which generally lower surface temperatures on the planet (Svensmark 2007). Cosmic rays may also affect the electrification of thunderstorms, which is related to lightning and the severity of the storms, and cosmic rays may affect ice formation in storms. The magnetic field of Earth acts as a shield against cosmic rays, with the shielding effects varying over time as the magnetic field fluctuates and also varying among geographic locations on the planet (the magnetic field varies from place to place). Earth's magnetic field is strongly influenced by the Sun's magnetic field in complex ways as the two fields interact, and the geomagnetic field also varies in orientation and intensity for reasons that are not fully understood. The Earth's magnetic field has declined in strength by about 5 percent since the middle of the nineteenth century (Barry 2006), and there are credible scientific predictions that the geomagnetic field could disappear over the next millennium, then reappear in flipped form (reversed relative to the previous magnetic field; see McKie 2002). A weakened or nonexistent geomagnetic field would let in more cosmic rays and solar particles, subjecting Earth to abnormally large amounts of extraterrestrial radiation that could damage and destroy satellites and, depending on the intensity, ground-based electronics. The radiation may even pose a direct risk to life on the surface of Earth; perhaps the only way to escape would be via seeking shelter underground. Large increases in radiation could heat the atmosphere and cause major climate change. In a worst-case scenario, the ultimate consequences could be devastating. To quote Paul Murdin, of the Institute of Astronomy at the University of Cambridge, "These solar particles can have profound effects, . . . On Mars, when its magnetic field failed permanently billions of years ago, it led

to its atmosphere being boiled off. On Earth, it will heat up the upper atmosphere and send ripples round the world with enormous, unpredictable effects on the climate" (Murdin, quoted in McKie 2002).

While the effects of a significantly weakened geomagnetic field may remain speculative, it now seems clear that there are correlations between variations in the Sun's magnetic field (which affects the geomagnetic field) and weather in the short term and climate in the long term. To cite one important study, based on data going back to 1876, Robert G. V. Baker, of the School of Environmental Studies, University of New England, Australia, concluded, "The interaction between the directionality in the Sun's and Earth's magnetic fields, the incidence of UV radiation over the tropical Pacific, and changes in sea surface temperatures with cloud cover—could all contribute to an explanation of substantial changes in the SOI [Southern Oscillation Index, a measure of changes in surface air pressure between the tropical western and eastern Pacific] from solar cycle fluctuations" (Baker, quoted in *Space Daily* 2008).

Based on such studies, it appears that solar cycles, which are in large part magnetic cycles, correlate with changes in rainfall as well as variations in ocean currents (which in turn have many other climatic impacts). New understandings clearly indicate that relatively "minor" changes in the Sun can be magnified through various physical processes (for instance, the formation of clouds), with the result that such small variations have very large impacts on Earth. Overall, based on studies of detailed data spanning 1,800 years, Ilya G. Usoskin *et al.* (2005, 9) found "that periods of higher solar activity and lower cosmic ray flux tend to be associated with warmer climate, and vice versa."

Il-Hyun Cho and colleagues have found additional evidence that solar activity can directly affect the weather and climate on Earth. Solar winds (consisting of charged particles) are accompanied by "magnetic clouds" that can interfere with Earth's magnetism, disrupting our magnetic shield that regulates incoming particles and energy. Cho *et al.* (2011), analyzing data going back to the 1980s, looked at twelve high-speed solar wind events, comparing them with changes in air pressure at sea level over South Korea. They discovered a correlation between these events and slight increases in air pressure occurring just after the events. Most of these events were also accompanied by what are known as Forbush decreases, which are decreases in GCR intensity that are believed to be caused by the magnetic field of the solar wind removing GCRs from the vicinity of Earth. A Forbush decrease may occur during a CME, for

instance, and during such an event particles from the solar wind can be injected deep into Earth's atmosphere. These particles can heat the atmosphere, causing it to expand, therefore increasing surface pressures. The charged particles can also have other effects, such as ionizing atoms of the atmosphere, which in turn form nuclei promoting water droplet formation. The study of air pressure over South Korea is important because it demonstrates that such solar-induced effects take place not only at high magnetic latitudes, where Earth is more susceptible to such influences, but at relatively low latitudes as well.

Turning to the archaeological and geologically recent geomagnetic records, Yves Gallet *et al.* (2006) have suggested a correlation between geomagnetic events consisting of magnetic intensity increases (which they refer to as "archeomagnetic jerks"), cooling episodes in the North Atlantic region, enhanced aridity in the Middle East, and abrupt societal changes around 2600 BCE, 2000 BCE, and 1500 BCE to 1200 BCE. While one might expect a decrease in cosmic rays, resulting in a warming event and increased aridity due to an increase in the geomagnetic intensity, Gallet *et al.* found the opposite; however, it must be remembered that they were not necessarily looking at overall global climate changes (the climate in a certain region can cool even as the global climate warms overall), and there may be many other factors that they did not account for (for instance, solar variability and the Sun's influence on the geomagnetic field may have come into play).

As mentioned previously, Henrik Svensmark (2007) has offered a comprehensive new paradigm of climate modulation on Earth, which he labels cosmoclimatology. The core of this paradigm is the observed correlation between low-level clouds (below about three kilometers in altitude) and cosmic rays; more cosmic rays correlate with more low-level cloud cover. The cosmic rays release electrons and act as catalysts for cloud condensation nuclei. Cosmic rays in the atmosphere are affected by a number of factors, among the foremost in the present day being the magnetic field of the Sun. Stronger solar magnetism (generally correlated with a more active Sun overall, at least in recent times) sweeps away or protects Earth from cosmic rays, lowering their count and thus decreasing low-level cloud cover. Since cloud tops generally scatter and reflect incoming sunlight back to space rather than allowing it to warm Earth's surface, a less active Sun magnetically, correlating with more incoming cosmic rays and thus resulting in more low-level cloud cover overall, results in a cooler Earth.

Likewise, a more active Sun results in a warmer Earth. The data spanning a period of centuries and millennia on climate changes, solar activity, and cosmic ray fluctuations confirm these correlations.

Interestingly, and perhaps counterintuitively, the incoming cosmic ray flux affects primarily low-level clouds. Apparently there are always lots of cosmic rays available to induce cloud formation high in the atmosphere, but it is lower in the atmosphere that cosmic rays are in short supply (fewer of them make it down toward the surface), and thus changes in the quantity of cosmic rays are expressed primarily in changes in low-altitude clouds. Another aspect of Svensmark's work is "the Antarctic climate anomaly." While increased low-level cloud cover on Earth today generally decreases surface temperatures, over Antarctica the opposite is found to be the case. The explanation is that the bright snow and ice of Antarctica have a higher albedo, a higher reflective power, than even the low-level clouds. The result is that increased low-level cloud cover over Antarctica warms the surface locally, rather than cooling it. Data clearly show that over the last few millennia when overall surface temperatures of Earth decreased, those of Antarctica increased, and vice versa.

Svensmark (2007) notes that in the present day about 60 percent of all incoming cosmic rays have high enough energies such that they are not appreciably affected by either the Sun's magnetic field or Earth's magnetic field. About 37 percent of incoming cosmic rays have intermediate energies and are affected by the Sun's magnetic field but not by the weaker magnetic field of Earth. And only about 3 percent of incoming cosmic rays are of low enough energy that they are affected by both the Sun's magnetic field and Earth's magnetic field. Thus, in the present day it is the Sun's magnetic field that primarily influences low-level cloud cover and climate, with Earth's magnetic field playing a more minor role (but not necessarily an insignificant role, as very slight changes in temperature may have major ramifications for organisms on the surface of Earth, including humans).

Moving back in time from the present, the cosmoclimatology paradigm has been applied to explain major alterations in Earth's climate spanning millions, hundreds of millions, and even billions of years (Svensmark 2007). On a broad scale, it is recorded in the geological record that Earth has undergone major alterations between "hothouse" conditions (for instance, around 500, 375, 250,

and 100 million years ago) and “icehouse” conditions with periodic glaciations (for instance, around 450, 300, and 150 million years ago, along with the most recent ice age of the last few million years up to virtually the present, geologically speaking). These broad climatic changes appear to correlate with the movement of our solar system around the center of our Milky Way galaxy, with icehouse periods corresponding to encounters with spiral arms of the galaxy that have a concentration of explosive stars ejecting large numbers of cosmic rays, which in turn result in a cooling effect on Earth. Going back even further in time, there were widespread glaciations on Earth about 2.3 billion years ago and 700 million years ago. Based on astrophysical data, these were periods of high rates of star formation, which would have resulted in a significant increase of cosmic rays impacting our solar system and Earth.

While cosmoclimatology, as developed by Svensmark, helps to cogently explain many aspects of Earth’s changing climate, there is one area in which it so far fails: explaining the sudden onsets and, especially, the sudden terminations of ice ages. As Svensmark writes, “Large rises in temperature within the glacial periods, related to cosmic-ray decreases, do not melt the main ice sheets. Terminations leading to interglacial conditions seem to need an insolation trigger . . .” (Svensmark 2007, 1.24). I believe that the missing triggers, the missing pieces of the puzzle, are the quasi-periodic solar outbursts (CMEs, solar energetic particle events, and related phenomena) that can trigger interglacial and possibly also glacial periods as long as the “background” conditions are correct. (A less compelling argument, in my opinion, for the trigger to end an ice age is that as ice sheets and snow cover build up during an ice age, at some point their albedo will become higher than that of the clouds overhead and extra cloud cover will warm the surface, as presently seen in Antarctica, thus ending a glacial period. Such a mechanism cannot account for the extremely rapid increase in temperature at the end of the last ice age, circa 9700 BCE. The Greenland ice sheet, which is “dirty” and thus lacks the bright whiteness and high albedo of the Antarctic ice sheet, does not exhibit the “Antarctic warming mechanism.” The continental glaciers of the last ice age were assuredly closer in their characteristics to the current Greenland ice sheet than the current Antarctic ice sheet.) Clearly we can agree with Svensmark when he remarks, “The physics of the Sun and the heliosphere runs through the story on all timescales from the early Earth to the present day” (Svensmark 2007, 1.24). As we have seen, Svensmark is certainly not the only researcher who is finding correlations between climatological factors on Earth and factors

involving the Sun, our galaxy, and even stars and galaxies beyond the Milky Way.

Saumitra Mukherjee in an article titled “Cosmic Influence on the Sun-Earth Environment” (2008) reviews much of the literature on this subject, as well as contributing new observations. According to Mukherjee, not only can weather anomalies, such as droughts, storms, unusual hot and cold spells, and major rainfalls and snowfalls, be correlated with extraterrestrial factors (including starbursts; that is, exploding stars), but so can many earthquakes. Mukherjee writes, “. . . oscillations in the planet’s magnetic field often occur right before quakes; these oscillations . . . often correlate strongly with astronomical and solar events. But geologists are afraid to say something ridiculous along the lines of ‘sunspots cause earthquakes,’ despite the fact that, in a certain sense, they do . . . [ellipses in the original] radio wave propagation (e.g., ionospheric ‘whistlers’), which appears to play a role in earthquakes, and it can be studied by closely monitoring the impact of the solar wind on the ionosphere” (Mukherjee 2008, 7740).

Mukherjee then goes on to give recent examples including the following:

A sudden rise in electron flux and planetary indices 36 hrs before 26th January 2001 earthquake of Kutch, (Gujarat, India) and its sudden fall before the occurrence of [the] earthquake was observed. Similar observations were made in several other cases also including the Andaman Islands. Coronal Mass Ejection, increase in Kp values [a standard measure of geomagnetic activity] . . . , sudden increase in Kp indices and electron flux can be forewarning of seismic disturbance in earthquake prone active fault areas and other environmental changes of earth. On 24th January 2001 an Earth directed coronal mass was ejected, which took two days to reach the earth’s surface and may have triggered the active fault in the Katrol Formation of Kutch to produce a major earthquake of magnitude 7.9 in Gujarat, west coast of India. This area was reported as seismically active. In the entire world, a total of 65 earthquakes have been reported on the same day. (Mukherjee 2008, 7742)

Skeptics will say that these correlations are simple coincidences and not significant. But one certainly has to wonder. As we shall see in the next chapter, the work on earthquake prediction carried out by the late Raffaele Bendandi was in some cases amazingly accurate, and Paul LaViolette suggests that the 9.0

magnitude earthquake of December 26, 2004, off the west coast of Sumatra had an extraterrestrial cause.

9

GALACTIC SUPERWAVES AND INTERSTELLAR DUST CLOUDS

According to the new paradigm of cosmoclimatology, solar and galactic influences can have major effects on the climate of Earth. If the work of certain cutting-edge scientists is correct (as a scientist myself, I believe their work has validity), the extraterrestrial influences go far beyond those that we have discussed so far.

GALACTIC SUPERWAVES

Paul LaViolette has long advocated the proposition that our Earth and solar system are subject to periodic, intense volleys of galactic cosmic rays (GCRs), which he terms galactic superwaves (see LaViolette 2005, 2009). This was the subject of his 1983 Ph.D. dissertation at Portland State University, and it is a topic that he has pursued and refined ever since.

The galactic center of our galaxy, the Milky Way, is viewed from Earth in the direction of Scorpius, Sagittarius, and Ophiuchus, seen visually as the brightest region of the Milky Way. At the core of our galaxy is a black hole, as indicted by a sixteen-year-long study published in 2008 (see Ghosh 2008). In the 1960s and 1970s it was discovered that the cores of galaxies can undergo explosive phases, releasing tremendous amounts of energy—as much energy as hundreds of thousands to billions of supernovae going off at the same time (supernovae are extremely energetic exploding stars; see LaViolette 2009). Even though it was realized that our own galaxy might be subject to similar events, it was generally assumed that although there may have been some minor core activity perhaps as recently as fifteen thousand years ago, there has been no major core activity for millions of years and the core will remain relatively quiet and stable for millions of years to come. Furthermore, it was reasoned at the time, even if

the galactic core did undergo a major explosion, our location on the outskirts of the galaxy, some twenty-seven thousand or so light years from the center, would ensure that we would suffer few if any consequences.

LaViolette's work totally revises the thinking on this subject. Based on many lines of evidence, including analyses of ice core data that record such information as temperature and climatic changes, solar activity levels, acid fallout from the atmosphere, cosmic ray bombardments, and cosmic dust accumulations, LaViolette has come to some startling conclusions. First, the galactic core is much more unstable than previously believed. Instead of undergoing a major explosion on the order of once every hundred million years, it does so approximately once every ten thousand years. Second, our position toward the edge of the galaxy will do little to protect us from the onslaught of cosmic rays. The cosmic rays traveling outward from the core (the galactic superwave) at nearly the speed of light would affect the entire galaxy. Third, the last galactic superwave hit Earth around 12,900 years ago, near the end of the last ice age, impacting the climate and helping to drive many ice age animals to extinction (including mastodons, mammoths, and many types of birds). As we saw in chapter 7, LaViolette has argued that a solar proton event (SPE) hit Earth at the end of the last ice age. The galactic superwave may have initiated solar instability, resulting in a solar outburst and accompanying SPE.

According to LaViolette (2009) a galactic superwave could appear literally overnight. A brilliant blue-white light, brighter than Venus, will appear in the direction of the galactic center. Then, within days, cosmic rays traveling close to the speed of light will hit. As they do, not only will we be showered with particles directly, but the cosmic rays (charged particles) moving at ultrarelativistic speeds (near the speed of light) through the magnetic fields of space also will emit electromagnetic radiation known as synchrotron radiation. And cosmic rays hitting atoms in the atmosphere will release even more radiation. In all, Earth will be bombarded by a plethora of radiation taking various forms, including radio waves, visible light, UV light, X rays, and gamma rays. Amidst all of this, I believe extreme auroral phenomena will be seen in the skies all over the globe. I also believe that the bombardment of cosmic rays and energy from the galactic core will destabilize and energize the Sun, resulting in massive solar outbursts. Some of these will surely hit Earth, which in a weakened state (with the atmosphere damaged and the magnetosphere

compromised) will be all the more vulnerable. Indeed, LaViolette notes (2009, 3) that even a minor galactic superwave event would have many of the same effects as a major solar outburst (such as a Carrington-level event or greater). In particular, as the galactic superwave hits it will bring with it a high-intensity electromagnetic shock, known as an electromagnetic pulse (EMP). This will cause surges in power grids, damaging transformers and resulting in blackouts around the world (see Maccoby 2010). Satellites, electronic communications systems, computer equipment, and other electronics will be damaged or destroyed. Earth's atmosphere could be ionized, the ozone layer will be thinned or lost completely, and UV light and radiation penetration to the surface will increase.

LaViolette also suggests that a large galactic superwave entering our solar system would vaporize frozen cometary debris and blow the resulting dust and gases into the solar system. The cosmic dust could enter Earth's atmosphere, scattering sunlight, trapping heat in the upper atmosphere, and possibly causing the lower atmosphere to become considerably cooler. Turbulence and imbalances in the atmosphere, as it adjusts to new conditions, would lead to severe storms with increased precipitation that, if conditions are cold enough, could accumulate as snow and ice. LaViolette believes he has found just such cosmic/cometary dust in the Greenland ice record.

Dust and other materials crashing into the Sun, according to LaViolette, "would energize the Sun, increasing its luminosity and its cosmic ray output" (2009, 4). This could result in solar outbursts, including flares, SPEs, and CMEs, that could ultimately cause the climate of Earth to heat up (as well, of course, as wreak havoc on the surface). Ultimately, to quote LaViolette, "On some occasions the invading cosmic dust could produce a prolonged cold spell or even initiate an ice age if one was not already in progress; at other times it could produce a period of excessive warmth which could terminate an existing ice age or produce a brief interstadial [a relatively warm period during a glacial age]" (LaViolette 2009, 4).

LaViolette cites the work of Herbert A. Zook and colleagues (Zook *et al.* 1977), who analyzed solar flare tracks preserved in the glassy surfaces of Moon rocks (ionized particles given off from the Sun and traveling through the glass damage the silicate structure, which is observable microscopically). Based on

their analyses, Zook *et al.* concluded that solar flare activity, which can be taken as an overall measure of solar activity, has varied by a factor of fifty over the last sixteen thousand to twenty thousand years, with a peak in activity around the end of the last ice age. They roughly estimate this peak activity at sixteen thousand years ago, but this estimate could be off by several thousand years, and I believe the peak activity may correlate with the very end of the last ice age, which for present purposes I am considering to be about twelve thousand years ago. In deriving their estimate, Zook *et al.* assumed that the meteoroid impact rates on the Moon have remained relatively constant over the time period they analyzed. LaViolette contends, "If the cratering rate was higher prior to 10,000 BP [before the present], as the Galactic Explosion Hypothesis suggests . . . then the solar flare activity change . . . would be underestimated. The peak at 16,000 BP would then be expected to increase and shift to a more recent date. Thus this data would be compatible with the solar outburst date of 14,000 calendar years BP (12,000 C–14 years BP) . . ." (LaViolette 2011b). If the solar system, including the Moon, was being bombarded with dust and debris at the end of the last ice age, causing meteoroid impact rates to be higher than since that time, as would probably be the case if a galactic superwave hit, then the lunar data can be interpreted with even more confidence to indicate an extremely active Sun at the end of the last ice age.

Based on his interpretation of the prehistoric record, LaViolette believes that the next galactic superwave could hit at any time. According to his basic analysis, a galactic superwave should hit Earth about once every ten thousand years, and the last one occurred at or near the end of the last ice age, which is on the order of 11,700 years ago—so we may be overdue! Predicting the time of the next galactic superwave on the basis that they occur about every ten thousand years is very crude and approximate. In June 2009 LaViolette and his colleagues at the Starburst Foundation analyzed ^{10}Be deposition peaks in ice cores. Deposition rates of ^{10}Be are an important indicator of cosmic ray activity, which in turn is related to solar activity; typically low solar activity (and colder temperatures) is followed by high solar activity (and warmer temperatures) as we saw in the case of the ice cores from Kilimanjaro (see discussion in chapter 7). They found recurrent patterns indicative of the following time periods: 28,500 +/- 2,200 years; 11,500 +/- 550 years; and 5,750 +/- 100 years (LaViolette 2009, 11). By my analysis, if the last major period of elevated solar activity was at the end of the last ice age, about 11,700 years ago, then we are just about due (or slightly overdue) for the next wave of high solar activity

(whether it is due to an incoming galactic superwave, which "energizes" the Sun, or some other factor). I would also note that there are signs of unusual solar activity, involving wide swings between high and low sunspot numbers, during the period of circa 4000 BCE to 3000 BCE (see Usoskin *et al.* 2007); this may correspond to the 5,750-year cycle detected by LaViolette and his group, and again suggests that we are on the verge of the next period of increased solar activity.

GRAVITATIONAL WAVES AND EARTHQUAKES

LaViolette (2009, 3–4) suggests that a galactic superwave electromagnetic pulse (EMP) could be accompanied by a gravitational wave (essentially a ripple in space-time, predicted by Einstein's theory of general relativity). The passing of a major gravitational wave could, LaViolette suggests, trigger earthquakes and volcanic eruptions on Earth. As evidence for such an effect, LaViolette points to the 9.0 magnitude earthquake of December 26, 2004, off the west coast of Sumatra, which caused a massive tsunami. On December 27, 2004, Earth was hit by a major gamma ray burst from a giant flare given off by an ultrahigh-magnetic neutron star located nearly fifty thousand light years away (Wanjek 2005; Kazan 2009). It has been estimated that more energy was released from this flare in one-tenth of a second than the Sun has given off in the last one hundred thousand years (Kazan 2009). Is there a connection between the two events—the earthquake and the onslaught of gamma rays? LaViolette believes so. According to LaViolette the gamma ray burst would be accompanied by a gravitational wave, but the gravitational wave would propagate very slightly faster than the gamma rays, and thus strike Earth slightly before the gamma rays, triggering the earthquake.

LaViolette is not the first person to suggest that increased earthquake activity or seismic activity (including volcanic activity) may be linked to extraterrestrial factors. In Iceland studies have linked global warming to increased volcanic activity (Brahic 2008). To put it simply, the melting of thick ice caps decreases the pressure on the rocks and magma below, increasing the rate at which the magma melts and migrates to the surface, which ultimately results in an increase in the number and/or intensity of volcanic eruptions. It is estimated that Vatnajökull, the largest glacier on Iceland, is currently melting at a rate of five cubic kilometers a year simply due to current global warming. Beyond increased local volcanic activity, the release of pressure in one area of the crust may

propagate or transmit stress changes to other portions of the crust (and underlying layers), perhaps even tens, hundreds, or thousands of kilometers from the place where the ice is melting. This could result in increased earthquake and volcanic activity around the world. Likewise, increased pressure can cause stress, resulting in greater volcanic and earthquake activity; the pressure could be due to the buildup of ice (for instance, during an ice age) or, more applicable to the present day, to sea-level rises that redistribute large amounts of water, which are of considerable weight, over the surface of Earth. Volcanologist Bill McGuire, professor of geohazards at University College London, is quoted by *New Scientist* as stating, relative to the current level of global warming, "We are going to see a massive increase in volcanic activity globally. If we look back at previous warm periods, that is what happened" (McGuire, quoted in Brahic 2008).

By one analysis, using United States Geological Survey data, the annual earthquake energy of Earth rose by a factor of five times between 1973 and 2007 (Chalko 2008). I personally question whether some of this apparent rise may be due to better monitoring of earthquake activity over the decades, but even a rise of, say, 20 percent (rather than the 500 percent reported) would be significant in my opinion. The author of this earthquake study, Tom J. Chalko, has also suggested that global warming could cause the overheating of the interior of Earth to the point that it might suffer an internal meltdown and thence explode (Chalko 2004). Deep within Earth heat is generated by gravitational compression and radioactive decay, and this is what melts and keeps molten rock that spews from volcanoes, and it is the power source that drives tectonic activity. Chalko's basic argument is that if the surrounding atmosphere of Earth becomes too hot, then not enough heat will be able to escape quickly enough from the interior of Earth, and it may undergo a meltdown analogous to a meltdown in a nuclear reactor. This in turn, according to Chalko, could possibly lead to nuclear enrichment and ultimately a gigantic explosion. Ultimately I do not find this scenario convincing because, if for no other reason, geologically Earth has gone through periods during which atmospheric temperatures were much warmer than today and the planet did not explode.

Increased volcanic and earthquake activity due to present-day global warming is, in my assessment, a very real possibility, and the data appear to support that it is happening now. Picture the last ice age, with huge masses of ice

in the form of continental glaciers. Any factor, such as a major solar outburst that sends a CME and SPE hurtling our way, which could quickly melt the ice, might cause the crust to snap back and readjust after being pressed down for so long by such weight. Possibly this could cause sudden cataclysmic earthquakes and volcanic activity around the world at an order of magnitude or more greater than what we are experiencing today. It has been calculated that volcanic activity in Iceland was ten times more frequent ten thousand to twelve thousand years ago (Dacey 2010). Furthermore, torrential downpours would have simultaneously occurred as the heated atmosphere became laden with evaporated water, adding further to the havoc on Earth.

Here I believe it is worth mentioning the legendary Raffaele Bendandi (1893–1973), an Italian "self-taught seismologist" (he built his own seismographs that were sold worldwide) who was famous (or infamous, depending on one's point of view) for his earthquake predictions. Bendandi first came to public attention when an earthquake struck the Italian province of Le Marche on January 4, 1924. In November of the previous year Bendandi had registered his prediction with a notary that an earthquake would strike on January 2, 1924. Although he was off by two days, his forecast was still incredible. He went on to successfully predict a number of other earthquakes, including a major earthquake on May 6, 1976, that left nearly one thousand people dead and forty-five thousand homeless. The dictator Benito Mussolini (1883–1945) took Bendandi very seriously, awarding him with membership as a knight of the Order of the Crown of Italy but also banning him from making further predictions publicly, apparently because it was not good for tourism or the morale of his countrymen (for information on Bendandi, see Fidani 2009, 2011, and *Telegraph* 2011).

Is there anything to Bendandi's predictions? Cristiano Fidani, a physicist with the National Institute of Nuclear Physics, Perugia, has analyzed Bendandi's predictions in detail and found them to be remarkably accurate in many cases (Fidani 2009, 2011). The question, therefore, is how did he make his predictions? Apparently he based his predictions at least in part on tidal influences between the Sun, planets, Moon, and other celestial bodies. In this context, it is important to note that while the Sun contains over 99 percent of the mass of the solar system, the solar system has angular momentum as it rotates, and the planets account for about 98 percent of the solar system's angular

momentum (Mackey 2007, 967, endnote viii). As we have seen in previous chapters, there is clear evidence that the planets affect the dynamics of the Sun and the resulting solar activity. Bendandi was interested in the issue of what causes the sunspot cycles and how the solar cycles and associated electromagnetic phenomena may be correlated with earthquakes. According to Fidani, "Additionally, he [Bendandi] repeatedly stressed that earthquakes are events that affect the entire globe. According to Bendandi, it was this lack of a global vision regarding the event that prevented others from successfully forecasting. Why he did not reveal the prediction method was due to the difficulty Bendandi had in identifying the location of events" (Fidani 2009, 3).

Since Bendandi's death in 1973, an increasing number of scientists are taking seriously the idea that earthquakes and volcanic activity may have extraterrestrial causes. Richard Mackey summarizes some of this work:

According to Barkin and Ferrandiz (2004), the tidal forces of the sun and moon acting on the earth as a whole produce elastic energy that resides in the earth's core and crust that is significantly greater than the sum of the elastic energies of the separate pairs of bodies.Some of the elastic energy is dissipated as heat and contributes, as the periodicities of the tides determine, to the warming of the earth and the oceans. Most of the remainder is retained in the solid material of the earth, resulting in deformations, ultimately in the form of earthquakes and volcanoes. Some of the elastic energy is retained by the moon, resulting in moonquakes which correlate closely with earthquakes. Barkin and Ferrandiz (2004) found that the formation of elastic energy is non-linear. The moon and the sun periodically amplify each other's gravitational effect on the earth in a non-linear manner that closely correlates with major earthquakes. Major earthquakes and moonquakes coincide with extreme variations in tidal elastic energy. (Mackey 2007, 959–60)

The scientific community is slowly realizing that such factors, which are correlated with solar activity, which in turn affects the climate of Earth, cannot be ignored if we are to truly understand the dynamics of our planet, the Sun, and our solar system as a whole. Bendandi's ideas may be vindicated.

ARE WE ENTERING A COSMIC INTERSTELLAR CLOUD?

The popular concept of interstellar space—deep space, the seemingly infinite distances between our solar system and the next star or solar system—is one of blackness and nothingness, a vacuum. It turns out that this is a misconception. Although certainly a vacuum by everyday standards, the “interstellar medium” (as it is commonly called) contains in extremely rarified form mostly hydrogen (typically about 89 percent) and helium (about 9 percent) atoms, along with the atoms of various other elements, charged particles, and miscellaneous molecules and particulate matter that are perhaps best referred to as dust. Our solar system is in large part protected from the interstellar medium by the barrier set up by the heliosphere, effectively a bubble around our solar system created by the Sun. This bubble is a result of the solar wind, which is composed of charged particles and magnetic fields (a moving electrically charged particle creates a magnetic field) emanating from the Sun at speeds on the order of several hundred kilometers per second. At some point beyond the orbits of Neptune and Pluto the solar wind slows down and meets the interstellar medium.

A shock wave, or termination shock, forms at the outer edge of the heliosphere where the solar wind particles moving out meet the interstellar medium particles rushing in (moving on the order of hundreds of kilometers per second). Beyond the termination shock is the heliosheath, an area that seems to be filled with magnetic bubbles (each on the order of up to hundreds of millions of kilometers wide; Atkinson 2011) created by the interactions between the heliosphere and the interstellar medium. The theoretical boundary beyond which the solar winds do not seem to penetrate (at least not to any great extent) into the interstellar medium is known as the heliopause.

Adding to the complications of the heliosphere is the fact that the Sun rotates on its axis, carrying or moving the solar wind and associated magnetic fields. This creates a rotating wave or ripple structure that can be pictured as the twirling skirt of a spinning dancer. Furthermore, the entire solar system is moving relative to the interstellar medium. This creates a bow shock, not unlike the wake left by a ship as its bow cuts through the water. And the interstellar medium is not consistent throughout. It varies greatly, ranging from relatively dense and cold areas (“molecular clouds”) containing about a million atoms or molecules per cubic centimeter (10^6 molecules per cm^3; for comparison, liquid water contains approximately [on the order of the magnitude of] 10^{22}, that is, ten

thousand million million million molecules per cubic centimeter) to hot and rarefied regions containing but a single ion or atom per ten thousand cubic centimeters (10^{-4} per cm^3). As our solar system moves through the interstellar medium it encounters, enters, and passes through clouds and other inhomogeneities (perhaps small accumulations of gas or clusters of interstellar debris, maybe the remnants of an exploded star) of varying densities. Key questions are, Where is our solar system now relative to local interstellar clouds and bubbles, and where is it headed in the future?

Why are such questions even important? Because they address phenomena that could—almost certainly will—have direct consequences for life on Earth. No one really knows what the consequences of entering a dense interstellar cloud will be, but there are various models and theories as to what might happen. The increased pressure of the dense cloud on the heliosphere could cause it to contract in size and also begin to leak as interstellar particles enter the inner solar system. Earth itself could be bombarded with energetic protons and cosmic rays (not truly rays at all, but moving charged subatomic particles), which in turn could deplete the oxygen in our atmosphere, damage the ozone layer (thus letting in more dangerous UV radiation), and as they smash into atoms in our atmosphere, would create even more dangerous and high-speed subatomic particles, X rays, gamma rays, and the like (Winters 2008). That is, we would be showered with increased levels of radiation on the surface of Earth. Some researchers believe that the shower of particles penetrating the atmosphere could cause more clouds to form, decreasing the amount of sunlight reaching the surface and increasing the amount of precipitation, ultimately cooling Earth and possibly sending it into an ice age. Interstellar dust, it has also been suggested, could “pollute” the interplanetary medium, the space between the Sun and Earth, thus blocking some of the sunlight from reaching Earth and causing our climate to cool.

Rather than the climate cooling, however, just the opposite may ultimately occur. The addition of cosmic particles (“cosmic dust”) to our solar system, if they reach all the way to the Sun (as could indeed occur if we meet a dense cloud), could potentially energize and destabilize the Sun, resulting in massive solar outbursts (such as CMEs and SPEs). This could be similar to the energizing effect on our Sun of a galactic superwave, as mentioned by LaViolette (2009, 1) and discussed previously in this chapter. It might be that meeting an interstellar

cloud would initially, and over a very short period, cause increased radiation levels and climatic cooling on Earth, followed shortly thereafter by major global warming correlated with solar outbursts from the Sun.

But what does all this matter? The fact is that there is evidence that we, our solar system, are either on the verge of entering or in the process of entering an interstellar cloud. The time frame for this to occur, possibly measured in years rather than decades, is too close for comfort.

In 1978 Alfred Vidal-Madjar (2007 recipient of the Ampere Prize of the Academy of Sciences, France, among other awards) and his colleagues published a paper in *The Astrophysical Journal* with the provocative title "Is the Solar System Entering a Nearby Interstellar Cloud?" Their conclusion was yes. According to their calculations, based on the data then available, there is a nearby interstellar cloud in the direction of Scorpius-Ophiuchus (that is, close to the direction of the galactic center). Our solar system is approaching this cloud (or it is approaching us) at a velocity of 15 to 20 kilometers a second, and it is currently 0.03 parsecs (about one-tenth of a light year) away. Doing a couple of quick conversions and calculations, assuming that we are approaching the cloud at 20 kilometers per second and it is indeed 0.03 parsecs away, then we should meet up with it in about 1,500 years. From an astronomical point of view, this is a mere blink of the eye and a time so close it might as well be tomorrow, or even yesterday for that matter!

More recent work has confirmed that there are many interstellar clouds in our immediate galactic neighborhood, including one we are approaching in the direction of the galactic center, as determined by Vidal-Madjar *et al.* (1978). In a 2008 paper, also published in *The Astrophysical Journal*, Seth Redfield and Jeffrey L. Linsky documented fifteen nearby (within fifty light years of us) interstellar clouds and determined that our solar system is currently between the Local Interstellar Cloud (so named because it was originally believed that we were within the boundaries of the cloud) and the G cloud (the closest cloud to us in the direction of the galactic center) and that we are moving at a rapid rate toward the G cloud. In a press release prepared by the University of Colorado, where Redfield and Linsky carried out their research, their conclusions are summarized as follows, "We're now on a collision course with the G cloud, which stands between us and the galactic center. Linsky says we'll enter the G cloud in less than 5,000 years—perhaps even tomorrow. Once that happens,

there's a chance the G cloud will affect the Sun's solar wind and Earth's climate" (University of Colorado 2008).

This is in agreement with the work of three decades earlier. And note that Linsky estimates the date of entry could be anywhere from "less than 5,000 years" in the future to tomorrow. As I already stated, a few thousand years is a blink of the astronomical eye.

In more general terms, Saumitra Mukherjee, professor of geology and remote sensing at the School of Environmental Sciences, Jawaharlal Nehru University, New Delhi, India, suggests that our solar system has already entered some type of interstellar cloud. He writes:

The Sun has entered the zodiac's 13th house. An interstellar wind hit our planet. It's a helium-rich breeze from the stars, flowing into the solar system from the direction of Ophiuchus. The Sun's gravity focuses the material into a cone and Earth passes through it during the first week of December. Earth was inside the cone during 25th December 2004 and 23rd February 2005. Grains of stardust are very small, about one hundredth the diameter of a human hair, hence they do not directly influence the planets of the Solar System. However, the dust particles move very fast, and produce large numbers of fragments when they impact asteroids or comets. It is, therefore, conceivable that an increase in the amount of interstellar dust in the Solar System will create more cosmic dust by collisions with asteroids and comets. It is possible that the increase of stardust in the Solar System will influence the amount of extraterrestrial material that rains down to Earth. How the Earth's surface temperature adjusts to a given change in star-solar radiation depends on the processes by which the climate system responds to variations in the energy it receives. . . . Some of these factors amplify the effects of changes that are imposed; others reduce them. (Mukherjee 2008, 7748)

Someone who is also adamant that we are entering an interstellar cloud sooner rather than later (indeed, he agrees that we may have already entered it at this point) and that it will have, and perhaps already is having, major ramifications for life on Earth is the Russian geophysicist Alexey N. Dmitriev. In a 1997 paper originally published in Russian and subsequently translated into English with the title "PlanetoPhysical State of the Earth and Life," he summarized his basic conclusions as follows:

Current PlanetoPhysical alterations of the Earth are becoming irreversible. Strong evidence exists that these transformations are being caused by highly charged material and energetic non-uniformity's in anisotropic interstellar space which have broken into the interplanetary area of our Solar System. This "donation" of energy is producing hybrid processes and excited energy states in all planets, as well as the Sun. Effects here on Earth are to be found in the acceleration of the magnetic pole shift, in the vertical and horizontal ozone content distribution, and in the increased frequency and magnitude of significant catastrophic climatic events. There is growing probability that we are moving into a rapid temperature instability period similar to the one that took place 10,000 years ago. The adaptive responses of the biosphere, and humanity, to these new conditions may lead to a total global revision of the range of species and life on Earth. It is only through a deep understanding of the fundamental changes taking place in the natural environment surrounding us that politicians, and citizens alike, will be able to achieve balance with the renewing flow of PlanetoPhysical states and processes. (Dmitriev 1997)

Dmitriev bases his conclusions on Russian analyses of geophysical and astrophysical data, including data from space probes to the outer edges of the solar system, such as Voyager 1 and Voyager 2 (both launched by NASA in 1977). Using the Voyager information as a baseline, Dmitriev and his colleagues have determined that changes have been taking place in the solar system as a whole in recent decades, changes that shortly will, or already are beginning to, directly impact the Sun and Earth. According to Dmitriev, "This development of events, as it has become clear in the last few years, *is being caused by material and energetic non-uniformity's in anisotropic interstellar space.* In its travel through interstellar space, the Heliosphere travels in the direction of the Solar Apex in the Hercules Constellation. On its way it has met (1960s) non-homogeneities of matter and energy containing ions of Hydrogen, Helium, and Hydroxyl in addition to other elements and combinations. This kind of interstellar space dispersed plasma is presented by magnetized strip structures and striations" (Dmitriev 1997, italics in the original).

Essentially, Dmitriev is stating that our solar system is entering an interstellar cloud, in agreement with other researchers, such as Vidal-Madjar and colleagues and Redfield and Linsky (discussed previously in this chapter). Also, Dmitriev estimated that the cloud is in the direction of the Hercules Constellation;

Hercules is just north of Scorpio-Ophiuchus and the galactic center, so this is in agreement too with the work of other independent researchers.

As is apparent from his summary, quoted above, Dmitriev (1997) predicts that there will be major, even catastrophic, effects on Earth as we enter the interstellar cloud. Some of the things we should expect are:

A strengthening shock wave in front of the heliosphere, ultimately leading to the input of matter (at least partially in the form of plasma), radiation, and energy into the inner solar system.

New and unusual solar phenomena, including a general increase in the activity of the Sun. The magnetic properties of the Sun are changing, which in turn affects the heliosphere. Increased solar outbursts can be expected, including CMEs, with the result that geomagnetic storms on Earth will increase in frequency and magnitude. (*Geomagnetic storm*, also sometimes referred to as a geomagnetic disturbance, is a general name for a major disturbance in Earth's magnetosphere caused by factors external to Earth, such as a solar outburst.)

Transformations in the atmospheric envelope that encompasses Earth (including the ionosphere [ionized by solar radiation] at very high levels, the stratosphere, and the troposphere down to ground levels) could result in climatic disturbances and extremes, including an increase in major storms, such as cyclones, hurricanes, and typhoons. The ozone layer of the stratosphere will be affected, with less ozone in the stratosphere (where it protects us by absorbing harmful UV radiation) and more ozone at and near ground level (where it is a highly reactive and dangerous chemical that can threaten life). Reiterating, Dmitriev states, *"There is a growing probability that we are moving into a rapid temperature instability period similar to the one that took place 10,000 years ago"* (1997, italics in the original). Here he is referring to the climatic changes that took place at the end of the last ice age.

Increases in seismic activity, including major earthquakes and volcanoes, on Earth. Seismic/geological effects are correlated with, and possibly triggered or influenced by, solar activity, according to Dmitriev and his colleagues. Major underwater earthquakes can create enormous tsunamis, and volcanic activity spewing ash into the atmosphere can impact the climate.

Significant shifts, on the order of over one hundred kilometers per decade, in the magnetic poles of Earth, possibly accelerating to two hundred kilometers per

year. Since Dmitriev's paper was published in 1997, his predictions of accelerating shifts in Earth's magnetic poles seem to be coming true (see discussion in the section on "Earth's Magnetosphere" in chapter 7).Ultimately the poles could invert or flip. Furthermore, magnetic anomalies in the Earth's crust are increasing in number. In addition it should be pointed out that since the middle of the nine teenth century the magnetic field of Earth has been decreasing in strength (Barry 2006). Based on ships' logs and other data going back to about 1590, Earth's magnetic field was stable until around 1840 to 1860. After that, it began to decline in strength at a rate of about 5 percent per century, a decline that continues to this day. At the current rate, Earth's magnetic field will drop to zero within one thousand to two thousand years (McKie 2002) and then possibly "flip," building up strength in the opposite direction. However, if the decline in strength accelerates, as may be the case, according to the work of Dmitriev and his colleagues, the magnetic field could disappear and/or flip much sooner. As Earth's magnetic field declines, the magnetosphere provides less protection from solar radiation and other incoming materials and energy, making us even more vulnerable to solar outbursts or other onslaughts.

Dmitriev is not the only scientist who is concerned about Earth's weakening magnetic field. Gauthier Hulot, of the Paris Geophysical Institute, has found that the magnetic field is weakening, particularly near the poles of Earth, and this is interpreted as a sign that the poles are getting ready to flip (McKie 2002). Alan Thomson, of the British Geological Survey, Edinburgh, was quoted in 2002 as saying, "Earth's magnetic field has disappeared many times before—as a prelude to our magnetic poles flipping over, when north becomes south and vice versa. . . . Reversals happen every 250,000 years or so, and as there has not been one for almost a million years, we are due one soon" (Thomson, quoted in McKie 2002).

There is disagreement as to how long a full reversal of Earth's magnetic field might take. The standard view is that, from a human perspective, it will occur slowly and incrementally, taking thousands of years or longer. However, evidence from ancient lava flows in Oregon record a 6°change per day, meaning that a complete reversal (180°) could occur in only a month. This study was widely dismissed as implausible, with the results due to some error. Then another study of lava flows in Nevada indicated a change of 53° in a year. If this rate were constant through a full 180°, it would mean a reversal, a full flip of

Earth's magnetic poles, could occur in less than four years (Wilkins 2010). This is still amazingly fast. Another possibility is that it actually takes longer for a full pole shift and that the shift is not smooth and gradual. Perhaps it shifts in spurts and jerks of a few tens of degrees at a time and then settles down for several years or centuries before starting up again. The bottom line is that we just do not know, and thus we do not know what to expect in the future.

Ultimately Dmitriev believes that a major transformation of life on Earth, including human life, will be necessary. Humanity will be faced with major challenges, and we must transform and adapt ourselves if we are to survive. Dmitriev wrote in 1997:

This high-energy atmospheric phenomena, which was rare in the past, is now becoming more frequent, intense, and changed in its nature. The material composition of the gas-plasma envelope is also being transformed. It is quite natural for the whole biota of the Earth to be subjected to these changing conditions of the electromagnetic field, and to the significant deep alterations of Earth's climatic machinery. These fundamental processes of change create a demand within all of Earth's life organisms for new forms of adaptation. *The natural development of these new forms may lead to a total global revision of the range of species, and life, on Earth.* New deeper qualities of life itself may come forth, bringing the new physical state of the Earth to an equilibrium with the new organismic possibilities of development, reproduction, and perfection. In this sense *it is evident that we are faced with a problem of the adaptation of humanity to this new state of the Earth;* new conditions on Earth whose biospheric qualities are varying, and non-uniformly distributed. Therefore the current period of transformation is transient, and the transition of life's representatives to the future may take place only after a deep evaluation of what it will take to comply with these new Earthly biospheric conditions. Each living representative on Earth will be getting a thorough "examination," or "quality control inspection," to determine it's ability to comply with these new conditions. *These evolutionary challenges always require effort, or endurance, be it individual organisms, species, or communities.* Therefore, it is not only the climate that is becoming new, but we as human beings are experiencing a global change in the vital processes of living organisms, or life itself; which is yet another link in the total process. We cannot treat such things separately, or individually. (Dmitriev 1997, italics in the original)

But when will these dramatic changes occur? As he relates in his book

Apocalypse 2012, journalist Lawrence E. Joseph traveled to Siberia and spoke with Dmitriev directly. When Joseph pushed Dmitriev on the time frame for major impacts on Earth from the interstellar energy cloud, Dmitriev had this to say: “The global catastrophe—hurricanes, earthquakes, volcanoes synchronizing and amplifying each other in a positive feedback loop that will spin out of control, threatening the very existence of our modern civilization—we have been talking about should probably happen in ones, not tens, of years” (Dmitriev, quoted in Joseph 2008, 142–43).

This is pretty scary stuff, coming from a well-respected scientist (according to Joseph, Dmitriev has published over three hundred articles in academic journals, written several scholarly books, and is the recipient of numerous awards and citations in his homeland; Joseph 2008, 120).

Dmitriev is certainly not the only physicist who believes major changes on Earth could happen sooner rather than later. While researching his book *Apocalypse 2012*, Joseph visited and interviewed physicist Pierre J. Cilliers of the Hermanus Magnetic Observatory in South Africa (the name of the observatory was changed to SANSA [South African National Space Agency] Space Science on April 1, 2011; see SANSA 2010). Cilliers researches geomagnetic activity, including intense disturbances in the geomagnetic field and their ramifications, such as the risks posed by geomagnetically induced currents (see for instance the paper by Ngwira *et al.* 2011, on which Cilliers is a coauthor). He is also an avowed Christian. In his interview with Joseph, Cilliers stated, “The Lord said that a sign of the end of times would be an increase in storms, earthquakes, and other catastrophes. He is the author of the Bible and the author of Nature. When we see conflict, it is either because we don’t understand his Revelation or because we confuse our observation” (Cilliers, quoted in Joseph 2008, 216).

When asked by Joseph about the possibility that the world could either end or profoundly change in 2012, Cilliers answered, “It is not unlikely that this will occur in our lifetime” (Cilliers, quoted in Joseph 2008, 217).

What about profound changes during previous lifetimes? A strong case can be made that the Judeo-Christian Bible, the Bible that Cilliers cites, contains accounts of solar outbursts and plasma events that occurred during ancient times.

10

EZEKIEL'S VISION

Let us turn to the ancient records once again. Further evidence supporting the theory that both the petroglyphs studied by Anthony Peratt and his team (Peratt 2003; Peratt *et al.* 2007; Peratt and Yao 2008; van der Sluijs and Peratt 2010) and the rongorongo glyphs represent powerful auroral forms and plasma configurations in the sky comes from the Judeo-Christian Bible.

In the first chapter of the book of Ezekiel it is written, "I looked; a stormy wind blew from the north, a great cloud with light around it, a fire from which flashes of lightning darted, and in the centre a sheen like bronze at the heart of the fire" (Jerusalem Bible, 1968, Ezekiel 1:4).

This is often regarded as the clearest description of an auroral display in the Bible (see Eather 1980, 35; Silverman 2006). Ezekiel was probably making his observations around 593 BCE from Nippur (approximate geographic latitude 32° north and geographic longitude 45° east), about one hundred kilometers south of Babylon (Siscoe *et al.* 2002). The fact that Ezekiel's "vision" originated in the north is in agreement with a major auroral display, and based on the graphs of sunspot and solar activity as reconstructed by Solanki *et al.* (2004) and Usoskin *et al.* (2007), this may have been a period of strong solar activity, with major fluctuations between high and low numbers of sunspots.

There are those who question whether Ezekiel was observing an auroral display. William Hutton and Jonathan Eagle (2004, 145, footnote 13) state, "Details of Ezekiel's vision following verse 4 do not comport with an auroral display." In fact, though, the very opposite may be true. The details of Ezekiel's vision, understood in the context of the imagery commonly used to describe major auroral displays in ancient, medieval, and Renaissance times, are very

much in accord with a major, spectacular auroral and/or plasma display. This imagery in turn is very similar to that seen on the petroglyphs studied by Peratt and his team and in the rongorongo glyphs.

Ezekiel continues his description as follows:

In the centre I saw what seemed four animals. They looked like this. They were of human form.

Each had four faces, each had four wings.

Their legs were straight; they had hoofs like oxen, glittering like polished brass.

Human hands showed under their wings; the faces of all four were turned to the four quarters.

Their wings touched each other; they did not turn as they moved; each one went straight forward.

As to what they looked like, they had human faces, and all four had a lion’s face to the right, and all four had a bull’s face to the left, and all four had an eagle’s face.

Their wings were spread upward; each had two wings that touched, and two wings that covered his body;

And they all went straight forward; they went where the spirit urged them; they did not turn as they moved.

Between these animals something could be seen like flaming brands or torches, darting between the animals; the fire flashed light, and lightning streaked from the fire.

And the creatures ran to and fro like thunderbolts.

I looked at the animals; there was a wheel on the ground by each of them, one beside each of the four.

The wheels glittered as if made of chrysolite. All four looked alike, and

seemed to be made one inside the other.

They went forward four ways and kept their course unswervingly.

Their rims seemed enormous when I looked at them and all four rims had eyes all the way round.

When the animals went forward, the wheels went forward beside them; and when the animals left the ground, the wheels too left the ground.

Where the spirit urged them, there the wheels went, since the spirit of the animals was in the wheels.

When the animals moved on, they moved on; when the former halted, the latter halted; when the former left the ground, the wheels too left the ground, since the spirit of the animal was in the wheels.

Over the heads of the animals a sort of vault, gleaming like crystal, arched above their heads;

Under this vault their wings stretched out to one another, and each had two covering his body.

(Jerusalem Bible, 1968, Ezekiel 1:5–23)

Describing or depicting powerful auroral displays in anthropomorphic and zoomorphic terms as living creatures moving through the sky surrounded by or in the midst of fire and with rings or wheels is an iconography found among many ancient classical (Greek and Roman) through Renaissance writers and authors (Eather 1980; Laine 2004; Guskova *et al.* 2010). Sometimes the imagery was described as warring armies or as strange mixed animal-human figures (as by Ezekiel) that often included bird-like features, such as bird's heads or wings. During the 1859 Carrington Event, the auroral display seen from La Unión, San Salvador, was described as including figures "painted with fire": "On the night of Sept. 2d, a most extraordinary phenomenon was witnessed . . . a dense black cloud arose in the east, and commenced to spread over the colored portion of the heavens, presenting a most curious spectacle; for in the parts where the cloud was not dense enough, the red light shone through, and formed a thousand fantastic figures, as if painted with fire on a black ground" (quoted in Loomis

1860, 265–66; see also Clark 2007, 20).

Here it is worth noting that these “fantastic figures” were particularly prominent through cloud cover. During major solar outbursts with their accompanying auroral and plasma configurations, unlike anything witnessed in historical times, but the likes of which occurred prehistorically, including at the end of the last ice age, incineration and the setting of fires on the ground could promote cloud formation. Furthermore, even if the clouds were extremely dense, the incredibly powerful (perhaps orders of magnitude greater than occurred during the Carrington Event) and bright plasma configurations would shine through, creating the “fantastic figures” recorded in petroglyphs around the world and in the rongorongo.

Wheels and rings in the skies are also commonly referenced in historical descriptions of auroral displays, and as Silverman (2006, 206) has pointed out, nineteenth-century descriptions of great auroras (including the ones associated with the Carrington Event) in some cases included descriptions of wheels in the sky. Independently, Peratt (2003) has predicted and modeled various anthropomorphic, bird-like, and wheel-like forms that would be seen in the skies during major solar outbursts and their associated plasma discharges. Furthermore, this same imagery is seen in the petroglyphs studied by Peratt and colleagues and in the rongorongo glyphs.

Ezekiel continues his detailed description, adding yet another element, that of sound.

I heard the noise of their wings as they moved; it sounded like rushing water, like the voice of Shaddai [God], a noise like a storm, like the noise of a camp; when they halted, they folded their wings, and there was a noise.

Above the vault over their heads was something that looked like a sapphire; it was shaped like a throne and high up on this throne was a being that looked like a man.

I saw him shine like bronze, and close to and all around him from what seemed his loins upward was what looked like fire; and from what seemed his loins downward I saw what looked like fire, and a light all around like a bow in the clouds on rainy days; that is how the surrounding light appeared. It was something that looked like the glory of Yahweh. I looked, and prostrated myself,

and I heard a voice speaking. (Jerusalem Bible, 1968, Ezekiel 1:24–28)

Sound has often been associated with auroras in popular accounts, both ancient and modern. Additionally, trained researchers have on occasion described hearing sounds in conjunction with auroras. In different locations and across various cultures and peoples, the descriptions have generally been similar: hissing, crackling, rustling, or swishing sounds (Hautsalo 2005). Yet the scientific community in recent years has generally dismissed such auroral sounds as either other sounds only mistakenly considered to be emanating from auroral displays or as simple imagination and fantasy (Laine 2004). In large part this was because of the modern perception that auroral displays seen to the eye are typically on the order of a hundred kilometers or so in altitude, and therefore it was believed that no audible sound could travel down to ground level and be heard. Now, it turns out, sounds created by or associated with major auroras do indeed appear to be real, even if not always heard or often faint when heard, and they can be of rather inconsistent quality (Laine 2004; Hautsalo 2005; Solensky 2007). The cause of these sounds it still uncertain. One suggestion is that the sounds are the result of the buildup and discharge of static electricity at or near ground level. Another suggestion is electrophonic transduction due to very-low-frequency (VLF) radio waves associated with the auroras. Some VLF radio waves have the same frequencies as audible sounds, and very thin, long conductors such as hair or blades of grass might act as antennae, picking up the VLF radio waves, vibrating and converting them into audible sound. Interestingly, VLF radio waves have been detected in conjunction with both auroral displays and meteors, and in both cases similar types of sounds have been reported. At any rate,the point here is that Ezekiel was not necessarily incorrect to associate sound with an auroral display, and to describe the sound as the “noise of their wings” is in agreement with the way that auroral sounds have often been described.

Of course, Ezekiel ultimately heard more than rustling, hissing, crackling, and swishing sounds from the auroral display; God spoke to him explicitly. This part of Ezekiel’s vision is well beyond what one can expect from an auroral display directly, but Ezekiel was after all a priest, a prophet, and a visionary. He was subject to ecstatic and mystical states and probably trained in the interpretation of omens, and we should not be surprised that the genuine sight of a powerful auroral display would result for Ezekiel in a direct message from the

Almighty. The auroral displays associated with the 1859 Carrington Event inspired religious forebodings and end-times fears. A specific example was given in the October 8, 1859, issue of *Harper's Weekly:* "In Columbus, Ohio, a sixteen-year-old girl described as 'of considerable intelligence and prepossessing appearance' was taken into custody by a Sheriff after witnessing the auroral display. 'Her agitated state necessitated that she be moved to the lunatic asylum. The conclusion drawn from this, and no doubt her utterances, implied that she had become deranged from viewing the aurora borealis a short time ago. She was convinced that all of this spectacular auroral activity meant that the world was soon to come to an end'" (quoted by Green *et al.* 2006, 153).

RONGORONGO

The mysterious Easter Island rongorongo script appears to match both the petroglyphs that Peratt and his team have been studying and more generally the broad descriptions (such as Ezekiel's vision) ascribed to major auroral phenomena observed over the ages. I realize that this interpretation of rongorongo may not make certain linguists in particular happy, but so far there has been no compelling decipherment or interpretation of rongorongo otherwise. Yes, many hypotheses have been put forth, but none has been universally agreed on. Indeed, there has not even been agreement on whether rongorongo is truly a form of writing per se. Do the glyphs represent speech sounds or syllables? Are they effectively an alphabet? Or do the glyphs represent words or morphemes (small units that have meaning in a language, including morphemes that stand alone or can modify other morphemes, such as prefixes and suffixes or morphemes that denote plural)? Perhaps rongorongo is some type of mnemonic device or protowriting using some set of symbols representing ideas, concepts, and things (ideographs and pictograms). Some people would even suggest that it was basically used for decorative purposes.

Given the traditions of how the rongorongo tablets were valued and held in reverence, it is difficult to believe that they did not record something regarded as extremely important. And what could be more important than strange shapes in the sky that were associated with the catastrophes of the end of the last ice age? The rongorongo inscriptions that still survive, inscribed on wooden tablets, are clearly modern (that is, at most a few centuries old), but that does not mean their message cannot be much more ancient. Even among the corpus of classical Western literature, the oldest surviving physical manuscripts often postdate their

authors by a thousand years or more. For instance, the oldest surviving manuscript for about half of the dialogues of Plato (circa 429–423 BCE to 348–347 BCE), now housed in the collection of medieval manuscripts of the Bodleian Libraries at Oxford University, was produced in Constantinople and dates to circa 895 CE, over 1,200 years after its author died. Or, to give another example held by the Bodleian, the library system contains the oldest known copy of the *Discourses of Epictetus* (circa 55–135 CE, recorded by his student Arrian, circa 86–160 CE), and the copy dates from the twelfth century CE, a thousand years after it was originally written.

Based on the similarity of the rongorongo glyphs to the images seen in the skies during super auroral events and, as modeled by Peratt (2003), powerful solar outbursts and the resulting plasma configurations that would have been observed, I believe that the rongorongo glyphs were initially inspired by those events in the skies. The rongorongo was a record of what was seen—literally—and it was recorded in a way that made sense to the scribes and copyists of the time. In a like manner, Ezekiel's "vision" was indeed an accurate record, translated into the terminology and imagery of the day, of real events playing out in the skies. The rongorongo texts can be viewed as a sacred scripture, as a Rapanui "Bible," or more pertinent to this discussion, as a scientific text dating back thousands of years and recording in minute detail exactly what happened during that catastrophe of long ago. Apropos to such an interpretation of the rongorongo is the notion that many ancient myths, including those of the Greeks and Romans, were not simply fantasy stories but indeed were records and descriptions of real events playing out in the heavens. Pivotal in such studies is the work of Giorgio de Santillana and Hertha von Dechend, who in their 1969 book *Hamlet's Mill* argued persuasively that many classical ancient and European myths (such as those of the Norse) can be interpreted as recording movements and events in the heavens, including such subtle effects as precession.

Just as over time the deep astronomical meanings of classical Western myths were lost, both to the common folk and the educated elite (although one has to wonder if some still understood their full importance, but perhaps kept such knowledge secret), so too the original significance of the rongorongo may have been lost even as the characters and texts were faithfully copied and recopied. Even if some Rapanui still held the key to the rongorongo upon European

contact in 1722, their knowledge may have died with them as the Easter Island population was devastated over the following centuries. Interestingly, of the approximately twenty-six original rongorongo texts that have survived (there is disagreement over the authenticity of some), several texts are partial repetitions or close copies of one another, suggesting that these were very important texts of which there were multiple copies. This overlap would not be readily expected if the texts recorded mundane events. It is also not at all clear that the various texts all date from the same period. There are variations in the "punctuation" (or lack of punctuation), the actual forms of the glyphs, and the style and manner in which they were inscribed on the wooden tablets. I would not be surprised if the rongorongo, originally inspired by plasma configurations in the skies millennia ago, was also later used as a form of writing to record more mundane or trivial matters. In analogy, in other cultures writing may have originated for one purpose and then later was applied to other purposes. If this is the case, then a first step in fully interpreting and understanding the rongorongo texts might be to figure out which ones harken back to auroral displays and plasma configurations directly and which are more derived and may be the same or similar glyphs put to other uses.

Some of the work on attempting to decipher the rongorongo script may help support the plasma interpretation. One widely reported "decipherment" of the rongorongo is that good portions of the known texts are creation chants. A native Easter Islander informant named Ure Vaʻe Iko (Daniel Ure Vaeiko) in the late nineteenth century supposedly "read" some of the rongorongo inscriptions from the tablet known as Atua Matariri (most of the tablets have their own names) in the form of *"X, Ki ai Kiroto Y, Kapu te Z,"* where X, Y, and Z are the names of gods, goddesses, objects, or things (see Thomson 1891, 520). This phrase has been translated along the lines of "X, by copulating with Y, produced Z" or "X, by mounting into Y, let Z come forth"; thus, as an example of some such "translated" verses, we have "Moon, by mounting into Darkness, let Sun come forth," "Killing, by mounting into Stingray, let Shark come forth," and "Stinging Fly, by mounting into Swarm, let Horsefly come forth" (Wikipedia 2011a).

Following up on this reading Steven Roger Fischer has proposed a decipherment of the rongorongo, the core of which is triads of glyphs, along such procreation lines. To give one of Fischer's new translations, a triad from the Santiago staff (a wooden staff collected in 1870 by Chilean naval officers

and covered with rongorongo texts) reads, “All the birds copulated with the fish: there issued forth the sun” (Fischer 1997a, 200). Fischer applied this formula to other rongorongo texts, ultimately concluding, “Nearly all the surviving *rongorongo* inscriptions. . . are procreation chants. . . . In fact, only some 15 percent of the *rongorongo* corpus seems *not* to constitute procreation chants of this type” (Fischer 1997a, 207; italics in the original).

Honestly, at first I was dismissive of Fischer’s supposed translation, and indeed his work has hardly received wide acceptance. On analysis, other researchers have not found that the triads stressed by Fischer are nearly as common as he states, and it has also been pointed out that following Fisher’s translation scheme, virtually anything may be copulating with anything else, in all kinds of unlikely combinations (Wikipedia 2011a).

Another line of criticism of Fischer’s decipherment is that it is based on the “reading” of a nineteenth-century informant, but it is far from clear that Ure Vaʻe Iko could actually read the rongoronogo texts. He was under duress from the Westerners pressing him, and he may have effectively made something up to please them—not fabricated anew, but rather based on things he had either learned or simply overheard in his childhood and youth. In particular, Jacques Guy (Tehaha 2011; de Laat 2009, 211) has suggested that Ure Vaʻe Iko vaguely remembered what might be termed “spelling lessons” that he overheard or learned while positioned as a servant to the then king of Easter Island. Or, more specifically and accurately, Ure Vaʻe Iko may have vaguely remembered formulaic instructions on how to form compound glyphs from other glyphs—even if Ure Vaʻe Iko was not substituting the correct glyphs into the formula, but simply feeding nonsense to the Westerners who were actively pressing him and plying him with alcohol.

Taking auroral displays and plasma configurations into account as the possible inspiration for and intitial driving force behind the rongorongo, I do not think either the procreation chant hypothesis or the single-plus-single-to-compound-glyph hypothesis is totally ludicrous. In both cases, what do we have? One glyph combining with another to give rise to something else, or more generally one glyph or figure reacting, changing, morphing into another glyph or figure, which in turn may morph into another figure or figures, and so on and on. This is what would be seen in the skies during a major plasma outburst and what

was recorded in the form of the rongorongo glyphs. Later, possibly, the glyphs were also applied to other types of writing and recording purposes, but initially I believe they referred to events in the skies.

There is one rongorongo tablet that many of those who have seriously studied the rongorongo corpus agree appears to include a lunar calendar; that is, it is based on explicit observations of the sky. This is the tablet called Mamari (Thomson 1891, plates 44–45; Fischer 1997b, 412–18). The calendar section seems to record twenty-eight to thirty days (it is open to interpretation), indicated by what appear to be repeated crescent moons, along with repeated sets (apparently pairs or triads) of glyphs interspersed among the days and nights recorded (Guy 2011). No one has definitively interpreted what the interspersed glyphs may mean. Again, I wonder if they are recording configurations in the sky repeated over a period of a month.

Recently Mary de Laat (de Laat 2009) has offered a new and comprehensive decipherment and interpretation of rongorongo. In her book de Laat presents translations and interpretations of three rongorongo tablets, all of which (according to de Laat) are stories in the form of dialogues. One involves a man who is accused of murdering a woman, probably his wife. Another involves three women who had a bad encounter with a man who threatened them with "magic eyes" that can cast a curse. The third text that de Laat discusses involves some people, actually corpses, who, having been buried, are resurrected, but once brought back to life complain that they were better off dead (in "another state of awareness," as de Laat puts it, 2009, 110) since their bodies are damaged and mutilated, and they are thus apparently reinterred.

If there is validity to de Laat's interpretation, I wonder if the stories could have been inspired by, or be a recounting of, auroral displays and plasma configurations in the sky, combined with theological themes, not unlike Ezekiel's vision, which led to a direct message from his God. De Laat's work, however, has come under heavy criticism on many levels, including phonetically and grammatically, in terms of the use of Tahitian words and phrases that would not be expected in an ancient (precontact) language (Wikipedia 2011a, 2011b). On a broader scale, an anonymous Wikipedia contributor wrote, "It would be remarkable for these rare pieces of wood to record such exchanges verbatim. Yet the ligature . . . , which de Laat identified as a man named Taea, is found in six of the surviving texts, fully *half* of the corpus that is indisputably authentic and

in good condition, presenting this figure, who is supposed to have murdered his wife, as one of the most important protagonists in the Rapa Nui tradition. Yet there is no such Taea in the surviving Rapa Nui oral literature" (Wikipedia 2011a; italics in the original).

At this point only time will tell how well de Laat's interpretation of the rongorongo will stand up to further scrutiny. For my part, I believe that the evidence points to the rongorongo as a record of plasma outbursts in the ancient skies at the end of the last ice age, about twelve thousand years ago.

MORE BIBLICAL, ANCIENT, AND EVEN STONE AGE DEPICTIONS OF AURORAL DISPLAYS?

Other than the petroglyphs and rongorongo script, Ezekiel's description of an auroral display is not the oldest. Silverman (2006) notes Assyrian and Babylonian descriptions of the seventh and sixth centuries BCE (around the time of Ezekiel) that probably refer to aurora. In the Bible itself, an account in the book of Genesis, which may originally date back some four thousand years, could refer to auroral displays (Eather 1980, 34). "When the sun set and darkness had fallen, there appeared a smoking furnace and a firebrand that went between the halves" (Jerusalem Bible, 1968, Genesis 15:17). The imagery symbolizes God walking between the two halves of a dead animal in an ancient ritual used to seal contracts, in this case a covenant between God and Abram (Abraham).

Likewise in the book of Jeremiah (late seventh century BCE) it is written, "I see a cooking pot on the boil, . . . with its contents tilting from the North" (Jerusalem Bible, 1968, Jeremiah 1:13).

Although certainly not as conclusive as Ezekiel's description, this could be a reference to an auroral display. Here again it is important that the image, apparently seen in the sky, was from the north, as would be expected in this case for an auroral event, and auroras have been described many times throughout history as appearing to be like boiling pots (Eather 1980, 35).

The book of Zechariah (late sixth century BCE) records what may also be an auroral display. “I saw a vision during the night. It was this: a man was standing among the deep-rooted myrtles; behind him were horses, red and sorrel and black and white” (Jerusalem Bible, 1968, Zechariah 1:8).

In and of itself, it is questionable if this is based on an auroral event, but given the context of night, it is quite possible; the foliage, the man, and the horses and their colors all fit an auroral event.

In the second book of Maccabees (circa 170–168 BCE) another auroral display is very clearly recorded (see *National Geographic* 1939). “It then happened that all over the city for nearly forty days there were apparitions of horsemen galloping through the air, in cloth of gold, troops of lancers fully armed, squadrons of cavalry in order of battle, attacks and charges this way and that, a flourish of shields, a forest of pikes, brandishing of swords, hurling of missiles, a glitter of golden accoutrements and armour of all kinds. So everyone prayed that this manifestation might prove a good omen” (Jerusalem Bible, 1968, 2 Maccabees, 5:2–4).

One other possible biblical reference to auroral displays is worthy of mention here, that of the book of Enoch. Enoch the man is mentioned in the book of Genesis as being a seventh generation descendant of Adam; that is, he was from a very early period. The book of Enoch in its present form dates to the second or first century BCE (R. A. Gilbert, in Charles 2003, vii), but it is quite possible that it records much older traditions and images, passed down through the centuries and millennia to us. Considered in many mainstream circles to be heretical, by the late fourth century CE the book of Enoch was generally condemned and survived only through some fragmentary Greek manuscripts (the original language was probably Hebrew and/or Aramaic) and an Ethiopian translation (the Ethiopian Christian church being much more accepting of the book). Whatever their origin, the texts of the book of Enoch contain some vivid passages that can be interpreted as amazing auroral and plasma displays. Here is a sampling from the book of Enoch 17:9–11: “And I saw a flaming fire. And beyond these mountains is a region, the end of the great earth: there the heavens were completed. And I saw a deep abyss, with columns of heavenly fire, and among them I saw columns of fire fall, which were beyond measure alike toward the height and toward the depth” (Charles 2003, 16).

Going even further back in time, dating to the period of up to twenty thousand years ago or more, are human-created abstract, meandering patterns on cave walls, referred to by the French cave art researcher Henri Breuil (1877–1961) as macaronis. These have been interpreted as depictions of auroral displays (NASA 2006). In 1976 George Siscoe wrote, “The most dramatic example of this possibility is to be found on the ceiling of the cave of Rouffignac in France, where lines drawn in the red clay ceiling resemble the folded curtain patterns of the aurora” (Siscoe, quoted in van der Sluijs 2010).

Interestingly, the cave art of Rouffignac has been dated to circa 11,000 BCE (Milan 2003), or about the time of the end of the last ice age, a period that saw intense solar activity.

I wonder about other possible allusions to intense solar activity. Thinking back to the Great Sphinx, there is a record that Khufu repaired lightning damage to the statue—is this the remembrance of a major solar outburst? And then there is Göbekli Tepe, which Katie and I visited again in June 2012. We wonder if not only the “snakes” but also the “H” symbol that appear on various pillars could represent, in highly stylized form, a plasma configuration or “cosmic thunderbolt” with a pinch instability (compare the “H” to illustrations of plasma discharges and stylized “thunderbolts” in Talbott and Thornhill 2005).

Further supporting the contention that such literary and artistic creations as discussed above really do record auroral events is another line of evidence, but this time it is an absence of allusions to auroras in Norse (Viking) literature (including literature from or referring to Greenland and Iceland) of the period circa 700 CE to 1300 CE. On the face of it, many people would expect that of all the world’s literary creations, those of peoples living in the far north would most definitely include auroral descriptions; after all, it is the land of the aurora borealis, the northern lights. However, it turns out that there is a striking lack of such descriptions in the Norse literature from this period, with most references to the auroras being by people who had never actually seen them, but had only heard about auroras from others (Richman 1981). The explanation? At this time there was a lull in solar activity and the number of sunspots (Solanki *et al.* 2004; Usoskin *et al.* 2007), so auroral displays were much reduced in extent and number, and those that did occur were confined to exceptionally high latitudes, ever farther north than the Norse lived. This helps confirm that when

descriptions of auroras are found in the ancient and medieval literature, it means that such displays were real, genuinely observed phenomena. The descriptions do not occur when there were no such auroral displays to observe.

And there is another line of evidence supporting major auroral events and solar outbursts, evidence that comes from both European literary traditions and an archaeological enigma: vitrification.

11

GLASS CASTLES, FIRE FROM THE SKY, AND THE SPOILS OF THE GODS

Ancient Celtic traditions and Arthurian romances abound with tales of “glass castles” and “glass cities.” Ancient vitrified (that is, turned to glass) remains of stonework, buildings, and cities have been reported from around the globe (Nation 2002; Condick 2009). Here I am using the term *vitrification* in the sense of rock melted and turned to glassy substances; I am not including the more general concept of supposedly “softened” and “molded” rock (as, for instance, discussed by Jan Peter de Jong [2007–2008]). Admittedly some of the reports of vitrification are more reliable than others. Among the best-documented examples of ancient vitrification are various hill forts of the United Kingdom, particularly Scotland (Christison 1898). Having studied ancient hill forts in Scotland and Wales, I can testify to the authenticity of vitrification there. But what is its origin and significance? Drawing from decades of fieldwork that has taken me from Egypt to Easter Island, the answer I propose ties in with plasma and the new way of thinking about our ancient past that I am advocating in this book.

VITRIFIED FORTS

Relatively few people are aware of vitrified stone forts, one of the great mysteries of antiquity. To the untrained eye, vitrified forts are not particularly impressive. They generally appear to be walls of stone rubble, lacking any true masonry work, built on the tops of hills. The majority of known vitrified forts are found in Scotland, with others reported from England, Ireland, Wales, and also France, Germany, and as far afield as Turkey and Iran. A typical example of a vitrified fort, one that I have examined firsthand, is the Mote of Mark in Scotland.

What distinguishes a vitrified fort? The stone walls and structures have been

subject to intense heat, to the point where some of the rocks have melted and fused, forming masses of material that can resemble the slag produced when smelting and refining metals, similar to materials produced during some types of volcanic eruptions. It is referred to as vitrification (the Latin word *vitrum* means "glass") because the melted rock can solidify as a crude, generally dark, glass, which hundreds or thousands of years later may not look much like glass at all to the untrained eye. In order to melt and vitrify the rock, incredibly high temperatures are required—on the order of 1,000° Centigrade. The vitrification typically occurs on the tops and outer surfaces of the rock walls and not in their interiors. The big questions are, How could this occur, and why? Before we address these questions, we need to consider another thorny issue: the time frame of the vitrified forts, which in turn bears on the issue of how the forts may have been vitrified.

HOW FAR BACK DOES VITRIFICATION GO?

It is generally agreed among conventional historians and archaeologists that vitrified forts date back to at least the Iron Age (in the United Kingdom, about 800 BCE to the early centuries CE) and were used up through the early Dark Ages, circa 700 CE and later. The latter portion of this span, the late fifth and sixth centuries CE, corresponds to the time when the famous King Arthur supposedly lived and died. King Arthur and the Knights of the Round Table may have gathered at a vitrified hill fort known as Camelot. A Welsh manuscript records a poem, titled "PREIDDEU ANNWN" ("The Spoils of Annwn"; Annwn refers to the "otherworld" or the world of the gods; see Higley 2010), attributed to the British bard Taliesin of the middle and late sixth century CE. The poem tells of Arthur and a glass fortress or castle (for general comments on vitrified forts and glass castles of the Arthurian romances, see Comte 2002 and Squire 1905). Who would think of making a fort of glass? Traditionally the reference to glass has been seen as a fanciful metaphoric analogy to the realm of the gods and other beings. But could it have been rooted in reality? Could genuine vitrified forts have been the basis for the concept of a glass fortress or castle? I believe the answer is yes.

However, this is not to say the vitrified forts necessarily originated at the time of the legendary chieftain. Vitrified forts may have been an inheritance from a

much more remote period. Arthur and his contemporaries may have reused already very ancient forts, structures that had undergone vitrification centuries or millennia earlier. Indeed, the vitrified forts and other megalithic stonework might very well have been considered the “spoils of Annwn,” that is, the remnants of the world of the ancient gods. The Mote of Mark (the Scottish vitrified fort, also known as Rockcliffe) illustrates this possibility. During excavations, artifacts from the Roman and early Christian periods were found along with an abundance of material from the sixth and seventh centuries CE and even a piece of Mediterranean glass that could date to the ninth century CE. But, more remarkably, over a hundred worked flints possibly dating to the Mesolithic Period—that is, the period of circa 8000 BCE to 4000 BCE—were found (Royal Commission 2010). Thus, the Mote of Mark may trace its origins to ten thousand years ago and was intermittently used and reused over the course of nine millennia!

THE HOW AND WHY BEHIND VITRIFICATION

How did the Mote of Mark and other forts come to be vitrified? A number of explanations have been proposed (see Schoch 2010c). Some believe the builders of the forts did it purposefully, or alternatively that it was the result of attackers attempting to destroy the forts. If purposeful, perhaps vitrification was a way to bond and strengthen the rock walls in lieu of mortar. Huge amounts of wood and other flammable substances were presumably piled against the walls and set ablaze, creating intense heat and melting the surface rocks. The problem is that virtually all studies conclude that vitrified walls are actually weaker and more brittle than nonvitrified walls. The vitrification occurs only on the upper surfaces and tops of walls, which are otherwise built on foundations of rubble and thus could easily collapse.

Another popular theory suggests the vitrification resulted from enemy attacks. The forts were originally built of stone and wood, with wooden superstructures and in some cases wooden logs inside the stone and rubble walls. The assaulting enemy might have purposefully set the fort on fire, and the ensuing conflagration may have caused the vitrification. But could setting fire to a fort really generate the extremely intense heat necessary to melt rock? And why would the defenders continue to build structures containing so much wood that they were vulnerable to such attacks when there was certainly plenty of stone available?

Or, did the attackers possess a fire-based weapon that we no longer understand? Did they have something similar to modern napalm? Had they discovered a toxic mixture of flammable chemicals (the recipe a closely guarded secret that has since been lost) that could generate enormous temperatures and could not be extinguished? The classical ancients mention “Greek fire” that could be hurled and catapulted at the enemy and would even burn under water. But whatever Greek fire may have been, even if the accounts are not exaggerated, it is difficult to see how it could be used extensively enough to cause the amount and degree of vitrification seen in the forts.

Some researchers have suggested that vitrification along the tops of fort walls was the result of lighting beacon fires. But it is odd that beacon fires would be intense and hot enough to vitrify the rock. And those forts that are vitrified continuously around the perimeters, does that mean beacon fires were built in continuous lines along the tops of the walls? This too seems odd; it would perhaps make more sense to build beacon fires at designated spots best observed by those who were intended to see the fires. Or were the tops of the forts purposefully vitrified to make a sort of walking path?

At a loss to explain the reasons behind the vitrification of the forts, one researcher suggested vitrification was a purposeful ceremonial or religious rite, despite the fact that the vitrification weakens the structure! Perhaps, according to this theory, vitrification was used to dedicate or christen a fort, was an act of supplication to a deity, served to commemorate a victory or other significant event, or was done simply to inspire the masses. I cannot say that I find this theory particularly compelling.

More exotic theories have been proposed to explain the vitrification. One early idea suggested that the structures were built near ancient volcanoes and that the builders used naturally molten rock to construct their forts. In actuality the forts are not near active volcanoes, and how the builders would have transported and manipulated molten rock is a difficult question to answer. Another theory, popular to this day in some circles, is that the vitrification was the result of ancient atomic warfare. The vitrification occurs predominantly on the tops and outer edges of the walls, as if blasted by an incredibly intense heat from above. Furthermore, vitrified forts tend to be found on the tops of hills and other promontories. It certainly sounds like melted rock could have been

produced by an atomic bomb exploding in the sky above, but did the ancients have nuclear weapons in the remote past?

FIRE FROM THE SKY

As appealing as ancient nuclear weapons may be to some sensibilities, I have my doubts, and as a geologist I tend to look for other, more naturalistic explanations first. However, the evidence does suggest that the causative factor originated from the skies above. A possible explanation, which I have heard more than a few times from various people over the years, is that perhaps the midair explosion of a meteor, comet, or asteroid was responsible (Unexplained-Mysteries. com 2005). Such an incoming space object (bolide) could create a tremendous blast in the atmosphere, generating intense heat and massive destruction over a widespread area, as was the case in Tunguska, Siberia, in 1908. The Tunguska object exploded with an estimated force of between five hundred and two thousand Hiroshima atomic bombs, scorching and leveling trees over a vast area, yet no major crater formed, perhaps because the explosion took place about five to eight kilometers above Earth's surface. As I have documented in my 2003 book *Voyages of the Pyramid Builders*, Earth has had close encounters with comet-like objects, including the Tunguska incident, a number of times in the last six thousand years, and certainly many times prior to recorded history. Indeed, there is good documentation for a comet intersecting with Earth's orbit in the middle of the sixth century CE, the traditional period of King Arthur. Might a comet have been responsible, at least in part, for initiating the beginning of the Dark Ages, a time of calamity and loss? I find the comet explanation for the vitrified forts plausible, but there are other phenomena that originate in the sky as well. Even if it can be demonstrated that some vitrification dates to the sixth century and correlates with a cometary impact, it may be an incorrect oversimplification to conclude that all episodes of vitrification were due to close encounters with comets.

Major lightning strikes can cause intense heat discharges that result in the melting, fusing, and vitrification of sand and rock. Lightning that strikes silica or quartz sand (or similar substances) can cause the sand to melt, fusing the sand grains together to form natural glass tubes and other structures, known as fulgurites. The forts sitting at high elevations could have served as lightning rods, attracting intense electrical currents that resulted in their vitrification. But is simple lightning, as we know it today, intense enough and extensive enough to

explain the amount and degree of vitrification observed on the ancient forts? I believe something more is needed.

Lightning is actually a type of plasma phenomenon. Could at least some of the vitrification be due to plasma events? I believe so, and I believe that some of the forts date as far back as ten thousand years ago or more—the spoils of a primordial civilization, the spoils of the "gods"—and were hit by solar/plasma outbursts. This is what caused the vitrification and created the glass castles.

PLASMA IMPACTS

Certain common themes of antiquity may reflect the historical impacts of plasma phenomena. Let us look at a few examples.

Deluge stories are found around the globe (Heinberg 1989). Perhaps the best known is that of Noah and the Great Flood, related in chapters 6 and 7 of the book of Genesis:

God said to Noah, "The end has come for all things of flesh; I have decided this, because the earth is full of violence of man's making, and I will efface them from the earth.

Make yourself an ark out of resinous wood. Make it with reeds and line it with pitch inside and out. . . .

. . . For my part I mean to bring a flood, and send the waters over the earth, to destroy all flesh on it, every living creature under heaven; everything on earth shall perish.

But I will establish my Covenant with you, and you must go on board the ark, yourself, your sons, your wife and your sons' wives along with you.

From all living creatures, from all flesh, you must take two of each kind aboard the ark, to save their lives with yours; they must be a male and a female.

Of every kind of bird, of every kind of animal and of every kind of reptile on the ground, two must go with you so that their lives may be saved.

For your part provide yourself with eatables of all kinds, and lay in a store of them, to serve as food for yourself and them.”

Noah did all this; he did all that God had ordered him. . . .

. . . In the six hundredth year of Noah’s life, in the second month, and on the seventeenth day of that month, that very day all the springs of the great deep broke through, and the sluices of heaven opened.

It rained on the earth for forty days and forty nights. . . .

. . . The flood lasted forty days on the earth. The waters swelled, lifting the ark until it was raised above the earth.

The waters rose and swelled greatly on the earth, [and the ark sailed on the waters.

The waters rose more and more on] the earth so that all the highest mountains under the whole of heaven were submerged.

The waters rose fifteen cubits higher, submerging the mountains.

And so all things of flesh perished that moved on the earth, birds, cattle, wild beasts, everything that swarms on the earth, and every man.

Everything with the breath of life in its nostrils died, everything on dry land.

Yahweh destroyed every living thing on the face of the earth, man and animals, reptiles, and the birds of heaven. He rid the earth of them, so that only Noah was left, and those with him in the ark.

(Jerusalem Bible, 1968, Genesis 6:13–14, 17–22; 7:11–12, 17–23)

The story of Noah and the ark has many versions in different cultures (see review in Heinberg 1989). Examples include the deluge story of the Sumerian/Babylonian flood survivor Utnapishtim, related in the Epic of Gilgamesh (Foster 2001), and the Greek legend of Deucalion and his wife Pyrrha, who survived a flood, but flood traditions are much more widespread than the Mediterranean region, the Middle East, and Mesopotamia. In the Hindu

tradition the first man, Manu, is warned by a great fish of a coming deluge and is ordered to build a boat, which he stocks with seeds; the savior fish guides his boat to the highest peak of the Himalayas. In the mountains of Yunnan, in southwest China, the indigenous Lolos people tell the story of a great flood and the hero Du-mu, who survived with his sons (who were accompanied by otters, wild ducks, and lampreys) in a hollow log. The aborigines of central Australia pass on the tradition that a huge flood of long ago brought famine to the land and only a few people and animals survived on the mountain ridges. In the Americas there are numerous flood traditions, often featuring a hero and various accompanying animals who survive on a raft. In Hawaii there is an indigenous tradition of a great flood.

The book of Genesis tells of forty days and forty nights of rain, or in other words it rained continuously for an incredibly long period of time. What might have caused this? A major plasma event could vaporize large amounts of water from lakes and oceans, which in turn would rain down continuously and cause widespread flooding. My research has determined that the Great Sphinx in Egypt dates back minimally to circa 5000 BCE, and quite possibly back to 9000 BCE or earlier, and was subject to intense rains. Could these be rains that followed plasma bombardments?

But flood stories are not the only catastrophes recorded by ancient traditions. As Richard Heinberg writes, “While the Deluge is the most widely and vividly remembered catastrophe of ancient times, most cultures retained traditions of other world-destructions as well” (Heinberg 1989, 107).

Heinberg then goes on to give a number of examples. The Greek poet Hesiod (circa 700 BCE) spoke of the end of an age in the following terms: “The life-giving Earth crashed around in burning . . . all the land seethed. . . . It seemed even if Earth and wide Heaven above came together; for such a mighty crash would have arisen if Earth were being hurled to ruin, and Heaven from on high were hurling her down” (Hesiod, quoted by Heinberg 1989, 107). I cannot help but think this describes the long-distant memory of a major solar outburst, a major plasma event, and the subsequent geological disturbances.

The North American Hopi tribal traditions include accounts of the world being destroyed by fire from above and also the people seeking safety

underground (Heinberg 1989, 108–9). Again, plasma comes to mind. And according to some Hopi elders, their ancestors emerged from below the ground. Could these ancestors have been survivors of a plasma event who had sought refuge from the surface onslaught?

Major plasma phenomena could cause not only vitrification, but if sufficiently intense could also literally incinerate the surface of Earth, including human structures and artifacts. Only massive stone structures or materials that were buried, hidden in caves, or otherwise protected from the aerial bombardment would have a chance of surviving. Is this why the ancients often built megalithic stone structures (even after the plasma was gone, remembering what had happened in the past)? Do some of these stone structures actually belong to another time—to the "world of the gods"? Is this why in some regions dwellings were not so much built, but rather carved into cliffs or deep underground in bedrock? The extensive rock-cut churches and dwellings of Cappadocia (Turkey), the solid stone buildings of Petra (Jordan), the rock-cut churches of Lalibela (Ethiopia), and the cliff dwellings of the Anasazi (western United States) come to mind. Is some of this the handiwork of a more advanced people facing potential annihilation? Furthermore, a plasma event would significantly decrease the stratospheric ozone layer for years, or longer, subjecting all life to harmful UV light. One strategy to try to protect oneself would be to stay underground as much as possible during daylight hours (see Todericiu 2007). Perhaps this theory explains why we see no significant activity indicative of advanced civilization for thousands of years—until it kick-starts again in Egypt and elsewhere.

Plato (circa 429–423 BCE to 348–347 BCE), in his *Timaeus* (this dialogue and the accompanying *Critias* recount the Atlantis legend), writes of a memory of recurring catastrophes and ancient civilizations that were destroyed. In the dialogue an Egyptian priest is speaking to Solon of Athens (circa 638 to 558 BCE).

One of the priests, who was of a very great age, said: O Solon, Solon, you Hellenes are never anything but children, and there is not an old man among you. Solon in return asked him what he meant. I mean to say, he replied, that in mind you are all young; there is no old opinion handed down among you by ancient tradition, nor any science which is hoary with age. And I will tell you why. There have been, and will be again, many destructions of mankind arising

out of many causes; the greatest have been brought about by the agencies of fire and water, and other lesser ones by innumerable other causes. There is a story, which even you have preserved, that once upon a time Paethon [also spelled Phaethon or Phaeton or Phaëton], the son of Helios, having yoked the steeds in his father's chariot, because he was not able to drive them in the path of his father, burnt up all that was upon the earth, and was himself destroyed by a thunderbolt. Now this has the form of a myth, but really signifies a declination of the bodies moving in the heavens around the earth, and a great conflagration of things upon the earth, which recurs after long intervals; at such times those who live upon the mountains and in dry and lofty places are more liable to destruction than those who dwell by rivers or on the seashore. . . .

. . . Just when you and other nations are beginning to be provided with letters and the other requisites of civilized life, after the usual interval, the stream from heaven, like a pestilence, comes pouring down, and leaves only those of you who are destitute of letters and education; and so you have to begin all over again like children, and know nothing of what happened in ancient times, either among us or among yourselves. (Plato, *Timaeus;* translated by Benjamin Jowett [1817–1893])

These words from Plato are certainly subject to interpretation. Some would dismiss them as mere fantasy, while others might interpret them as referring to a comet hitting Earth (see for instance, Allan and Delair 1997). However, I believe they describe quite precisely a major solar outburst and the accompanying plasma discharge and the aftermath of such an event—including the virtually total destruction of any civilization of the time and the attendant losses. All that remains is a vague memory of the past age, often seen as a golden age, and the memory of the destruction of that age. As Heinberg points out, "It is worth noting briefly the existence of physical signs—signs of ocean-level changes and of the simultaneous extinctions of large numbers of plant and animal species—that suggests that relatively recent, worldwide destructions have indeed taken place. Geologists and archaeologists are generally undecided about the interpretation of this evidence and often refer to it as 'mysterious.' But for the mythologist and the psychologist, there can be no question: the *memory* of catastrophe is universal, and the terror persists" (Heinberg 1989, 111; italics in the original).

Plasma discharges are electrical in nature. We do not know the full effects

and ramifications of subjecting living organisms, including humans, to intense electrical fields. Those who survived might be altered genetically, mentally, and psychically. Laboratory studies demonstrate that plant seeds and fish eggs, subjected to strong electrical fields, can be altered genetically, giving rise to either previously unknown varieties of organisms or apparently ancestral organisms that were believed to have gone extinct. In one experiment normal trout eggs, electrically stimulated, gave rise to a giant trout (Bürgin 2007; see also Burke and Halberg 2005, for related work on the electrical properties of ancient monuments and their effects on living organisms, such as enhancing seed growth). Mental functioning and psychic ability are affected by electromagnetic fields (Burns 2003; Wilkinson and Gauld 1993; Schoch and Yonavjak 2008). Van der Sluijs and Peratt (2010, 35) suggest that humans subjected to strong electrical fields during heightened auroral activity and plasma discharges may have been subject to induced hallucinations. Depictions of such hallucinations, they suggest, may be found among ancient rock art and, along with direct renditions of auroral activity (in the form of the petroglyphs), may record major ancient plasma discharges. I wonder if such strong electrical fields could have consequences well beyond simple and temporary hallucinations. Could occasional periods of intense plasma phenomena on Earth act to alternatively accelerate, or decelerate, organismal change, both physical and mental? Might powerful plasma phenomena act as a switching mechanism, causing biological and mental changes? Many cultures have a tradition of cyclical change, such as the Gold, Silver, Bronze, and Iron Ages; the Yuga Cycle; or the Precessional Cycle of the World Ages (we are currently transitioning from the Age of Pisces to the Age of Aquarius). Might plasma phenomena be involved in transitions from one age to another?

We live in a plasma universe. A National Research Council report states, “Plasma is . . . ubiquitous in the universe. Plasmas pervade intergalactic space, interstellar space, interplanetary space, and the space environments of planets” (National Research Council 2004, 5). It is foolish to ignore the possibility that major plasma events have influenced our past—for they clearly have. And we can be certain the plasma will hit again.

In modern recorded history, the largest plasma event to ever hit Earth was the Carrington Event.

12

THE CARRINGTON EVENT

On Thursday, September 1, 1859, the British astronomer Richard C. Carrington was observing and sketching an unusually large and dark group of sunspots at his personal observatory at Redhill about thirty-two kilometers south of central London (Cliver 2006). Carrington, although technically an amateur (his family was in the brewery business), was an expert on the Sun and had devoted his time and resources to unraveling its mysteries. Suddenly, on that fateful day, at 11:18 a.m. local time (Greenwich mean time), Carrington observed intense white flashes of light coming from two locations within the sunspot group he was drawing. He was so startled by this unusual phenomenon that he wanted a witness to corroborate his observations. In his own words, he "hastily ran to call some one to witness the exhibition . . . [but he could find no one nearby], and on returning within 60 seconds, was mortified to find that it was already much changed and enfeebled" (Carrington 1859, 14; also quoted in Stewart 1861, 427).

The flashes were now "vanishing as two rapidly fading dots of white light" (Carrington 1859, 14), and by 11:23 a.m. they had disappeared. Carrington had observed firsthand an incredibly intense but short-lived solar flare. As it turns out, there was another witness to the event. Richard Hodgson was observing the Sun at the same time from his house and observatory at Highgate (about eight kilometers north of central London), and he too saw the white flashes (Hodgson 1859). (As a side note, this is sometimes referred to as the first solar flare ever reported [see, for instance, Cliver 2006, 119], but according to Brody [2002, 130], the early sunspot observer and electrical experimenter Stephen Gray observed a solar flare in 1705, but no one paid much attention to his observation.)

At Kew Observatory about sixteen kilometers east of central London self-recording magnetographs, owned by the Royal Society, were in operation

monitoring Earth's magnetic field. At the very time of Carrington's observation of the solar flare a relatively small but abrupt disturbance was detected in the tracings of the magnetographs (Stewart 1861). The magnetic field seemed to return to normal, but then about seventeen and one-half hours later all hell broke loose, and the magnetographs went off the scale. We now understand that this is what happens when a huge coronal mass ejection (CME)—a giant bubble of ionized gas ejected by the Sun—hits Earth's magnetosphere. The CME was not merely recorded on the magnetographs (now generally referred to as magnetometers), but it was seen around the world as incredible auroral displays in the night skies over the next several days—and at unusually low latitudes. More importantly, and tellingly, the telegraph systems of the time were widely affected. The two hundred thousand kilometers of telegraph lines then in use (Green and Boardsen 2006, 130) suffered major disruptions and failures, becoming unusable as unwanted electrical currents flowed through the wires. In some cases the telegraph operators found that they could disconnect the batteries they normally used and send messages via the induced current. In other cases the induced currents sent "fantastical and unreadable messages" (quoted from National Research Council 2008, 6). There were instances where sparks flew from telegraph receiving instruments, some operators were nearly electrocuted, and several telegraph stations reportedly burned down (Odenwald and Green 2008).

The 1859 geomagnetic storm, and its associated phenomena, is now generally referred to as the Carrington Event. The Carrington Event is not just an historical oddity, but is of extreme importance to both our understanding of the dynamics of solar outbursts and our ability to predict the ramifications of future solar events. For this reason it has been studied extensively, and it is worthwhile for us to look at it in a bit more detail.

The Carrington Event actually consisted of two parts, two CMEs, along with the accompanying geomagnetic storms and visible auroras, which occurred over the period of approximately August 28 through September 5, 1859. Around the world, as night fell, fantastical auroral displays were seen in the skies, beginning on the evening of August 28 at Greenwich. Simultaneously, magnetometers recorded violent magnetic disturbances, and telegraph systems were affected. By August 30 things had calmed down, and they remained so through August 31 and September 1 (the day Carrington made his remarkable observation), with the

exception of the small blip picked up by the Kew Observatory magnetometers (mentioned above) that coincided with Carrington's observation of a solar flare preceding the arrival of the CME. But then on September 2 more brilliant auroras appeared throughout the world, there was a larger magnetic disturbance than the August 28 and 29 event, and telegraph lines went absolutely crazy. Things did not calm down again until September 3 and 4, and the effects, in much diminished intensity, lingered for up to several days afterward.

There was no clear understanding in 1859 of the relationship of sunspots, solar flares, auroral events, geomagnetic disturbances, and the effects on practical technology, such as the telegraph systems of the time. Ironically, given that the event is commonly named after him, Richard Carrington, good scientist that he was, cautioned against too quickly concluding that there was a causal connection between the solar flare he observed and the auroral displays and geomagnetic disturbances. It could all be simply a matter of coincidence, or so he suggested, stating, "One swallow does not make a summer" (Carrington 1859, 15). We now have a better understanding of these phenomena and their interrelationships, but the picture is far from complete!

Based on modern analyses of the data, we can now tentatively reconstruct the major aspects of the Carrington Event (see Odenwald and Green 2008; Smart *et al.* 2006). In late August of 1859 a major sunspot group appeared. On or around August 26 and 27 a solar flare (although unobserved) may have occurred, as well as a solar proton event (SPE) and a CME. The CME may have taken on the order of forty to sixty hours to cross the distance from the Sun to Earth, arriving on August 28 and creating the first wave of outstanding auroras and the accompanying geomagnetic storm. When it reached Earth, the CME compressed Earth's magnetosphere. Based on the magnetometer readings, the magnetic field of the CME was in the shape of a large, spiraling helix. Initially the orientation of the magnetic helix actually reinforced Earth's magnetic field, but as the plasma continued to flow around and past Earth, its magnetic field pivoted such that the CME's magnetic field was opposite to that of Earth's, and it was at this point that the two magnetic fields interacted (they were said to reconnect), releasing tremendous amounts of energy, resulting in the magnificent auroras and the disruptions in telegraph services. As noted above, things settled down after a day or so.

On September 1, Carrington and Hodgson observed the solar flare. Given how bright it was, modern estimates suggest the surface temperature of the Sun at the point of emission was close to 50 million degrees Celsius. An enormous amount of energy was released, not only as visible light but also as intense X rays and gamma rays that, traveling at the speed of light, hit Earth eight and one-half minutes later. A CME was also released from the Sun, but charged particles take considerably longer than electromagnetic radiation (which includes visible light, X rays, and gamma rays) to cross from the Sun to Earth. In this particular case, however, the CME traveled more quickly than is typical. The late-August CME had effectively formed a cavity in space that had not yet been filled in by plasma from the solar wind, and thus the early-September CME traveled at a speed of some 2,380 kilometers per second, hitting Earth a mere seventeen to seventeen and one-half hours after leaving the Sun. As this CME hit, its magnetic field was pointed opposite to that of Earth's, resulting in an immediate geomagnetic storm and brilliant auroras at low latitudes. Intense currents were induced on the surface of Earth and in the ground, resulting in the disruptions to telegraph systems. The magnetosphere of Earth was compressed to just seven thousand kilometers or less (it normally extends to about sixty-five thousand kilometers or more), and the Van Allen belts (which normally trap incoming particles, protecting Earth) were temporarily eliminated.

Protons were accelerated by the solar flare and the CME to incredibly high energy levels and penetrated into our atmosphere, creating a major solar proton event (SPE). According to one estimate, this reduced the stratospheric ozone layer by 5 percent, and it took years to fully recover. Furthermore, energetic protons hitting the nuclei of nitrogen and oxygen atoms created a shower of neutrons that rained down onto the surface of Earth. In 1859 there was no technology to detect the SPE or the shower of neutrons and their associated elevated levels of radiation. Today, among other effects, there would be widespread failure of computers and other electronics.

By September 4 the CME had passed, and any lingering effects remained only for a few more days. In 1859 civilization suffered little more than a bit of inconvenience and minor damage to the telegraph system. Such would not be the case if a Carrington-level event occurred today!

Historically the Carrington Event is apparently the largest such event in the last 450 years (based on nitrate concentrations in ice cores going back to 1561;

see McCracken *et al.* 2001). However, based on the evidence of the petroglyphs and rongorongo texts, it seems clear that much larger solar outbursts have occurred in the past. And a truism of geology is that if something has happened in the past, it can happen again in the future—and all the indications are that a major solar outburst will occur sooner rather than later!

Another troubling aspect of such a major solar outburst is that, as we have already discussed to some extent, it may be incredibly difficult to impossible to predict significantly in advance. We may not be aware of its coming more than a few hours to a few days before it hits. It is worth quoting plasma physicist Paul Kintner, of Cornell University, once again: "The Carrington event happened during a mediocre, ho-hum solar cycle. . . . It came out of nowhere, so we just don't know when something like that is going to happen again" (Kintner, quoted in Brooks 2009).

An important consideration is that any incoming solar outburst has a magnetic field, which as we discussed earlier in this chapter relative to the CMEs of the Carrington Event, may take the shape of a spiraling helix. How this magnetic field aligns and interacts with Earth's magnetic field upon arrival of the solar outburst can be a major factor in determining how severe the effects of any particular geomagnetic storm will be (Vergano 2012). It can be very difficult or virtually impossible with current technology to determine the exact orientation of the magnetic field of an incoming solar outburst before it is detected by satellites, giving a very short lead time (measured in hours or minutes). Yet, even if we cannot predict the precise orientation of the incoming magnetic field, any large outburst will cause major disruptions to modern technological society. In the case of the Carrington Event, the spiraling magnetic field of the initial incoming CME changed its orientation as it passed by our planet, insuring (so it seemed) that the full effects of the outburst would be experienced on Earth.

RAMIFICATIONS OF A CARRINGTON-LEVEL EVENT (OR GREATER)

It is difficult to imagine the magnitude of the socioeconomic impact of a Carrington-level event or greater in the twenty-first century. I believe that the

clock is counting down until the next such event, and the longer the Sun retains its pent-up energy, the larger the next major solar event could be. At the same time, we as a society, with our increased reliance on ever-more-sophisticated and fragile electronics, are becoming increasingly vulnerable to even relatively small-scale solar events. These two trends are placing us on a collision course with disaster. And here disaster will be in the literal sense of the word; the word *disaster* can be taken to mean an ill-fated star (where *star* is used in the astrological sense of a star, our Sun, or a planet).

To make matters worse, modern global systems have become incredibly interconnected and interdependent. This results in efficiency when everything is running smoothly, but comes at the price of extreme vulnerability relative to what would have been minor disruptions in the past. To give one example, in an article in *The Nation* magazine, Matt Stoller writes, "Barry Lynn of the New America Foundation has been studying industrial supply shocks since 1999, when he noticed that global computer chip production was concentrated in Taiwan. After a severe earthquake in that country, the global computer industry nearly shut down, crashing the stocks of large computer makers. This level of concentration of the production of key components in a globalized economy is a new phenomenon. Lynn's work points to the highly dangerous side of globalization, the flip side of a hyper-efficient global supply chain. When one link in that chain is broken, there is no fallback" (Stoller 2011).

Applying this to a solar outburst, such as a Carrington-level event or greater, imagine if during the catastrophe the only factory producing a particular critical part, vaccine, or medicine was put offline.

In 2009 the staid British journal *New Scientist* published an article with the provocative title "Space Storm Alert: 90 Seconds from Catastrophe," which opens with the following lines:

It is midnight on 22 September 2012 and the skies above Manhattan are filled with a flickering curtain of colourful light. Few New Yorkers have seen the aurora this far south but their fascination is short-lived. Within a few seconds, electric bulbs dim and flicker, then become unusually bright for a fleeting moment. Then all the lights in the state go out. Within 90 seconds, the entire eastern half of the US is without power.

A year later and millions of Americans are dead and the nation's infrastructure lies in tatters. The World Bank declares America a developing nation. Europe, Scandinavia, China and Japan are also struggling to recover from the same fateful event—a violent storm, 150 million kilometres away on the surface of the Sun.

It sounds ridiculous. Surely the Sun couldn't create so profound a disaster on Earth. Yet an extraordinary report funded by NASA and issued by the US National Academy of Sciences (NAS) . . . claims it could do just that. (Brooks 2009; see also National Research Council 2008 for the NAS report that *New Scientist* is referring to)

In fact, this scenario is not so ridiculous at all, as the *New Scientist* article goes on to relate (see also *International Business Times* 2011b; Lovett 2011; National Research Council 2008). Indeed, if things do not change, it may be inevitable.

Our modern technological society is, without exaggeration, totally dependent on a constant supply of electricity. An immediate worry concerning a major solar outburst is the vulnerability of modern electricity grid systems—the wires that crisscross nations and, indeed, the entire world. The high-voltage systems will essentially act as huge antennae, picking up and channeling direct current (DC) as a result of a solar outburst. The power transmission lines are designed to carry alternating current (AC), and although the geomagnetically induced current may be relatively weak compared to the currents that normally flow through the transmission lines, since the geomagnetic current is a DC current it can saturate the transformers and system (Jaggard 2011).

Among other effects, the all-important transformers along grid lines could heat up and melt, causing massive blackouts. This famously happened in Canada's Quebec province, when on March 13, 1989, a solar storm disrupted Hydro-Quebec transmission lines and in less than two minutes a blackout occurred, affecting six million people for nine to twelve hours (Berge 2011). In this particular case a billion-ton cloud of gas and plasma was released from the Sun, with the energy of thousands of nuclear bombs exploding simultaneously, and headed toward Earth at a speed of approximately 1.6 million kilometers an hour (Odenwald 2009). Besides the Quebec blackout, due to the solar flare accompanying the March 1989 solar storm (which was nowhere near the size of

the Carrington Event), short-wave radio signals were disrupted, including the jamming of Radio Free Europe, which was being broadcast into Russia; initially the Kremlin was suspected as the culprit. Such geomagnetic storms can affect the entire globe, especially the stronger storms (at the level of the Carrington Event and greater), but the immediate risk is most severe at higher magnetic latitudes due to the fact that the incoming electric currents are funneled or sucked into Earth's poles. Thus northern latitude Quebec was hard hit by the March 1989 solar storm, and during the solar storms that occurred around Halloween in 2003 there were blackouts in the city of Malmö, Sweden, and transformers failed in South Africa (Jaggard 2011).

But, returning to the March 1989 storm, not only Quebec was affected. Spectacular auroras were seen as far south as Florida and Cuba, indicative of the strength of the storm. In the United States no blackouts occurred as a result of the March 13, 1989, storm, but this was perhaps simply a matter of good fortune. Over two hundred power grid problems were reported across the United States within minutes of when the solar storm hit (Odenwald 2009). And there were still more direct consequences, as reported by Sten Odenwald: "In space, some satellites actually tumbled out of control for several hours. NASA's TDRS-1 communication satellite recorded over 250 anomalies as high-energy particles invaded the satellite's sensitive electronics. Even the Space Shuttle Discovery was having its own mysterious problems. A sensor on one of the tanks supplying hydrogen to a fuel cell was showing unusually high pressure readings on March 13. The problem went away just as mysteriously after the solar storm sub sided" (Odenwald 2009).

A May 1921 geomagnetic storm, caused by a solar outburst, was intermediate in size, between the 1859 Carrington Event and the March 1989 solar storm that affected Quebec. In 1921 electrical grid systems and associated technology were not nearly as extensive or as susceptible to geomagnetically induced currents as our systems are today. According to recent studies, a 1921-level solar storm could cause 300 to 350 or more large extra-high-voltage (EHV) transformers to fail or be permanently damaged in the United States, resulting in major electrical grid collapses with resulting blackouts for 130 million people, and the blackouts could last for years (see National Research Council 2008). Likewise, transformers would fail around the world; according to one estimate, over 2,000 EHV transformers could be adversely impacted globally (Stein 2012). Large

transformers, once damaged by overheating, burning, and melting, cannot be repaired but must be replaced. There are few crews trained to replace the transformers, and few spares of these large and expensive transformers on hand. Once the supply of spare transformers has been exhausted, new transformers will have to be manufactured. Even in normal times it can take a year or more to have a large transformer built and delivered. How will it even be possible to build transformers in areas without electricity to power manufacturing facilities?

The scenario described in the previous paragraph is based on the May 1921 geomagnetic storm. A Carrington-level event would be much worse. Plus, in either case, not only the United States would be hit, but nations around the world. Globally electrical grids would be damaged, with attendant blackouts. And it would be the most developed, technologically sophisticated, modern, industrialized countries that would be most affected. Less developed countries and regions, less dependent on modern infrastructure, would experience fewer disruptions, but given the interconnectedness of the global economy, surely they would ultimately feel the impacts too. Loss of electrical power for any length of time, say more than a day or two, is not a minor nuisance in the developed world. Our entire modern societies run on, and are dependent on, a ready and reliable supply of electricity. Without electricity, such necessities as water and sewage treatment would be affected, and in short order water would stop flowing in our public water systems. Those living in high-rise apartment buildings, where water has to be pumped to reach their floors, would lose water straightaway. All electrical appliances would stop working, from computers, lights (imagine the dark nights!), refrigerators, microwaves, and televisions to just about everything else associated with our electronically based society. Battery-powered devices would last only as long as the batteries hold—and then what?

Office buildings, apartment complexes, factories, government buildings, certain small communities, and so forth have backup generators, but such generators will last only as long as there is fuel to power them. Depending on what measures may be in place, within days or weeks the fuel will run out. Even if more fuel is theoretically available, without electricity there may be no way to deliver it. Gas pumps at service stations will not work without electricity; transportation by petroleum-powered vehicles will come to a halt. Furthermore, without electricity traffic lights (so essential to keeping order in large modern

cities) will stop functioning. Much public transportation in some cities, such as trolleys, subways, and electric bus lines, is directly dependent on electricity that will no longer be available. Underground tracks, such as for subways, may become flooded from penetrating rain and groundwater without electric pumps to keep them dry.

Buildings will lack air-conditioning, which is directly dependent on electricity. In hot areas, people may die from heat stroke, especially after the drinkable water runs out. In cold regions, buildings and people may freeze. Some heating systems use electricity directly. Others, which use oil or natural gas as the fuel, still depend on electricity to pump the fuel, to circulate water or air through the building, to ignite the fuel in the furnace, and to regulate the temperature through electric thermostats. No electricity, no heat!

Without refrigeration, many foodstuffs will quickly go bad. Even as people's food spoils, fresh supplies will be unavailable. With most or all transportation shut down, any food in supermarkets or food stockpiled elsewhere, will quickly run out and not be replenished. The same holds true for other items, from toilet paper to prescription drugs, which many people simply take for granted. Likewise medical supplies that need to be kept under controlled temperature conditions may be ruined, and as supplies are exhausted no more will be available. Indeed, any hospital, once the fuel supply for its emergency backup generators is exhausted, will be in very bad shape.

Ultimately, due to the devastation caused by a Carrington-level event (or greater), hundreds of millions of lives could be lost.

Ironically, many of the very things that make our modern society so "efficient," such as lack of redundancy (why keep old-fashioned bulky paper copies of records when they can be stored electronically?), not wasting space warehousing materials and supplies locally, and the concept of just-in-time delivery that is so dependent on steady and reliable transportation networks, make us especially vulnerable and even helpless in the face of massive grid failures and blackouts.

Beyond the disruption of electricity grid systems, electronic communication and satellite systems could be significantly disrupted. With a major solar

outburst, satellites could literally leave their designated orbits as the density of the atmosphere they travel through changes, causing them to change speed. High-frequency (HF) radio communications, such as those routinely used by aircraft, and HF navigation signals from global positioning system (GPS) satellites will be scrambled and disrupted. A major breakdown in communication systems could lead to literal anarchy. Even a government is dependent on reliable communications to govern and control the distribution of services and goods and maintain law and order.

During an extreme geomagnetic storm—that is, on the upper end of the geomagnetic storms actually experienced in modern times—induced currents in oil and natural gas pipelines can reach hundreds of amperes (National Research Council 2008, 40), leading to serious issues of rapid corrosion, the degradation and disintegration of the material of which the pipes are made. Rusting of iron is a form of corrosion. In pipelines corrosion can result in pitting, cracking, and ultimately leaking or full-scale failure of pipes. The exact effects of a Carrington-level event, much less a tremendous solar storm on the scale of those at the end of the last ice age, are unknown. It seems likely the induced currents could be strong enough to ignite the oil or natural gas in many pipelines. To make matters worse, during a major geomagnetic storm the flow meters can malfunction, and thus the magnitude of a leak, for instance, may not be readily measurable.

A very specific and serious worry involves the roughly 435 commercial nuclear power plants worldwide (104 in the United States), with another 63 under construction (figures as of February 2, 2012, from the European Nuclear Society 2012; there are also a number of noncommercial nuclear reactors). As was demonstrated by the March 2011 Fukushima Daiichi nuclear power plant disaster, when electricity is lost and cooling pumps can no longer keep the reactor cool, the reactor can overheat, potentially melting down (or exploding), and radioactive materials will be released to the environment. And it is not just the actual reactors that are of serious concern. Highly radioactive spent fuel rods are typically stored at nuclear reactor sites in containment ponds. These ponds must be continually cooled. It is estimated that with loss of power to the cooling system, the typical containment pond will boil away, and the spent fuel rods will become superheated, burn and/or cause explosions, releasing radioactive material into the environment (Stein 2012). In the face of a major solar outburst,

we could have hundreds of Chernobyl-type situations around the planet simultaneously and, with massive blackouts to boot, no foreseeable way to even attempt to realistically deal with the situations. It is difficult enough to attempt to address a Chernobyl-or Fukushima-level nuclear disaster in isolation!

One of the major results of a Carrington-level event could be the collapse of electronic-based financial and monetary systems. In the twenty-first century more and more of our financial transactions are carried out in terms of electronic money, that is, in terms of simply numbers in computers. There is for the vast majority of "money" in modern industrialized countries actually nothing beyond the electronic accounting system. The money has no physical backing—certainly not gold or other valuables, and not even paper bills or token coins. Quantitative finance expert Espen Gaarder Haug (2010, 2) points out that in 1991 the United States Federal Reserve determined that 69 percent of all U.S. dollars were in purely electronic form. Over two decades later this number has surely increased; Haug estimates that 90 percent of the U.S. money supply currently is purely electronic, and a similar situation occurs for many other countries.

In the case of a major solar outburst, one that would overload power grids, thus burning out transformers, causing widespread blackouts, disrupting communication systems, and damaging and destroying computers and all sorts of electronic systems, the basis for the global monetary system, as well as national monetary systems, could be destroyed. Not only would transactions be "temporarily" impossible (where *temporarily* could encompass not just days or weeks, but months or years), but also in many cases electronic financial records could be severely compromised or completely destroyed, such that it would be impossible to reconstruct the system as it was prior to the impact. The only saving grace might be if financial institutions and companies had their records securely backed up in safe havens well protected from the solar onslaught. Possibly the best bet would be storage in self-contained (certainly not connected to an external power grid) and secure caves and tunnels deep inside mountains with tens of meters of solid rock to provide shielding from radiation.

It seems that some governments are taking the threat of a major solar outburst seriously. During the summer of 2011 there were reports that "the British government has been warned that a massive surge of energy from the Sun could hit the Earth in the next 18 months. In a worst-case scenario, it could blow out the national grid and leave parts of the country without electricity for months"

(Don and Aikman 2011).

Therefore, according to the same article, the British government is making plans to deal with such a scenario, including invoking emergency powers to shut down the electricity grid (purposefully causing massive, though hopefully temporary, blackouts) in an attempt to protect the infrastructure from the worst effects. On the other hand, it was reported that in Australia (which is at lower latitudes than Britain and arguably therefore less vulnerable to some types of solar outbursts), ". . . electricity experts are not convinced the solar flare will have anywhere near the catastrophic effects predicted in Britain and think any electromagnetic surge will go largely unnoticed" (Don and Aikman 2011). One wonders, however, if the attitude expressed by the Australian officials—and the same holds true for government leaders and spokespeople elsewhere around the world—is actually a cover so as to avoid concern and potential panic among an ignorant public, even as those in the know secretly make plans to protect themselves and their institutions.

In the United States proposals have been made before Congress to invest in safeguards to help protect our electric grid systems from a major solar outburst. By one estimate, for a few billion dollars various measures could be put into place, such as building special protective devices into the electrical grid system, stockpiling and storing spare transformers and other parts and equipment (including backup generators and fuel) in secure locations (hardened steel containers and underground caves and facilities are possibilities), and storing at least a year's worth of diesel fuel for backup generators at every U.S. nuclear facility (Stein 2012). Unfortunately, so far Congress has failed to act positively on such proposals, worrying about seemingly more immediate concerns. (As a side note, many of the proposed safeguards and backup plans that have been suggested to help mitigate the damage caused by a major solar outburst would also be applicable to an attack on the nation using a powerful electromagnetic pulse [EMP]. Such an EMP would have many similar effects to those of a major solar outburst, including massive electrical discharges with disruption and damage to electronic systems, telecommunication systems, and electrical grid systems. By detonating a powerful nuclear explosion in the atmosphere over us, an enemy could create a major EMP.)

When will another major solar event occur—another Carrington level event or greater? How can we predict the next "big one"? One technique is to look at

the rates of occurrence of past solar events and from such data attempt to estimate probabilities for future events. Using this approach, Pete Riley of Predictive Science in San Diego has concluded that the probability of a Carrington-level event occurring within the next decade (that is, by 2022) is approximately 12 percent (Riley 2012). Another way of saying this is that there is a 1 in 8 chance of a Carrington-level event by 2022. This is a much higher probability than most scientists, including Riley, expected. However, it is only a probability over a given period of time, and it does not pinpoint when the next Carrington-level event will happen.

While some may put their trust in modern science to predict the next event, others turn to ancient prophecies—and to perhaps the most famous prophecy of all, one associated with a specific date that is attributed to the Mayan calendar and commonly correlated with our calendar as the year 2012. This is the next topic we need to explore.

13

THE 2012 DATE OF THE MAYA

Before entering into a chapter with “2012” in the title, let me be clear on one thing. I do not believe that anything dramatic, catastrophic, or cataclysmic will necessarily happen during the year 2012. I am writing these words in early 2012, and I fully expect that some of you reading this book will be doing so in the year 2013, or perhaps long afterward. I have never been a believer in the exact precision of the 2012 date. I consider the 2012 date to be much more figurative than literal. Figurative, that is, in the sense that something may happen, but not necessarily in 2012 or precisely on December 21, 2012. Rather, I believe that at some point in the first quarter or half of the twenty-first century a major catastrophe could occur on our planet. We may “hit the wall,” as Katie sometimes says. What the nature of this catastrophe might be, we cannot be absolutely certain; however, I believe that much of the evidence points to a major solar outburst and plasma event—and based on the hard science that we have discussed throughout this book, the catastrophe could be imminent. It could occur today, tomorrow, or twenty years from now. We just do not know when.

But people want to know when. Human nature is uncomfortable with uncertainty. Certainty (supposed certainty), even if based on ill-founded knowledge, is preferable to the human psyche compared to uncertainty. Some have found the certainty they seek in ancient prophecies, particularly those attributed to the Mayan culture of Central America.

The Maya were a highly advanced people living primarily in what is now southern Mexico, the Yucatan Peninsula, and the area of Guatemala, Belize, El Salvador, and Honduras, although their cultural influence spread much farther. The Maya possessed a sophisticated civilization that featured writing, incredible architectural achievements (including stone pyramids), and detailed astronomical knowledge. The “classic” Mayan period dates from about 250 CE to 900 CE, but

Mayan origins can be traced back to at least the middle of the third millennium BCE, and the civilization lasted up until European contact in the early sixteenth century. Indeed, the Mayan peoples are still with us to this day.

The Maya (and Mesoamericans more generally) used different calendars to keep track of different types of events and different lengths of time. The Calendar Round, which had a cycle of fifty-two years (approximately the lifetime of an individual), was used for many everyday purposes. The Long Count calendar was applied to long periods of time and various historical and pseudohistorical or mythological events; this is the calendar that ties in with the 2012 date popularized in some Western circles as the potential end of Earth, or at least the end of life as we know it. Just as we have days, months, and years, the Maya used five basic units for their Long Count calendar (Jenkins 2006): *kin* = 1 day, *uinal* = 20 days, *tun* = 360 days, *katun* = 7,200 days, and *baktun* = 144,000 days. After each period of thirteen baktuns (also referred to as *b'ak'tuns;* each baktun is approximately 394.25 years), according to one interpretation of the tradition, the calendar reset to zero and began again. Thirteen baktuns composed a "world age," and at the reset point the Maya believed an old world age came to an end, and a new world age or creation began. According to Richard Heinberg, "The Mayans counted their world ages as consecutive Suns—Water Sun, Earthquake Sun, Hurricane Sun, and Fire Sun —according to the nature of the catastrophe that closed the epoch" (Heinberg 1989, 62).

By one interpretation of the Mayan legends, we are currently coming to the end of the Fifth Sun or Age, and this Age will end with global destruction by fire and earthquakes. The previous Age, the Fourth Sun, ended in cataclysmic destruction caused by a worldwide flood, which was followed by a new creation inaugurating the Fifth Sun (Lehman 2008). The last creation took place on (according to standard accepted correlations between the Mayan calendar and the current Gregorian calendar) August 11, 3114 BCE (the so-called start date of the Mayan calendar), and the last day of the thirteenth baktun since then falls on December 21, 2012. Thus the present world age, the Fifth Sun, having lasted just over 5,125 years, will come to an end. What, if anything, will happen on that day or the next is the big question on many people's minds.

The date of December 21, 2012, (a Friday) corresponds to the winter solstice

in the Northern Hemisphere. That the Maya picked this as the “end point” of their calendar may not be insignificant. On the winter solstice the Sun is at its lowest in the sky and the daylight time is the shortest of the year. This is in concert with the imagery of catastrophe, but to me does not necessarily mean that catastrophe will hit precisely on December 21, 2012. In my opinion, the end point of the Mayan calendar could be a metaphor and warning for that which is imminent, but not a precise prediction of when the catastrophe will occur.

Paul LaViolette places some credence in the possibility that the end date of the Mayan calendar, conventionally accepted as December 21, 2012 CE, in the Gregorian calendar (but this date has been questioned, as we will discuss later in this chapter), might well mark some type of cataclysmic and catastrophic event; in particular, according to LaViolette (2009), the arrival of a galactic superwave (as discussed in chapter 9). Tying the Mayan calendar to modern science, LaViolette points to a minor ^{10}Be spike in the ice core record from Vostok (East Antarctica) dated to circa 3300 +/- 200 BCE that may represent a “relatively minor” galactic superwave and may also correlate with the 3114 BCE date marking the beginning of the Mayan calendar. I should also point out that there is evidence of abrupt climate change at approximately 3200 BCE in the ice core record of Kilimanjaro (eastern equatorial Africa; see Thompson *et al.* 2002). With the Vostok ^{10}Be spike in mind, LaViolette suggests, “The Maya may have designed their calendar not only to mark the date of arrival of this past superwave, but also to predict when the next one might come” (LaViolette 2009, 12).

LaViolette goes on to compare the 5,125-year cycle of the Maya (LaViolette refers to it as a 5,124-year cycle) to the 5,750 +/- 100-year cycle he found in the ^{10}Be record or possibly a slightly shorter potential cycle of 5,400 years that he and his group detected with much less certainty. It goes without saying that if both the Maya and their modern interpreters are correct, the next catastrophe (whether the arrival of a galactic superwave and/or a major solar outburst) is just around the corner.

But were the Maya even intending to predict a coming catastrophe? Were they aware of, or taking particular note of, solar-related events and the like? The answers to these questions run the range from one extreme to another.

Many modern researchers have predicted that the year 2012 will mark major changes on Earth. Catastrophic, apocalyptic, doomsday scenarios proliferate: volcanic and earthquake activity, a reversal of Earth's magnetic poles, or a change in the spin axis of Earth with devastating results as the ocean basins readjust and the crust of Earth is crumpled like a piece of paper wadded into a ball. As society collapses under the stress, the fabled Armageddon may be upon us, as foretold by prophecies of the American Hopi Indians, the biblical book of Revelation, the sibylline books of ancient Rome, and the quatrains of Nostradamus.

Major catastrophic changes are part of Earth history. Sixty-five million years ago the world changed forever and the dinosaurs were wiped out when an asteroid crashed off the coast of the Yucatan Peninsula of Mexico (Alvarez *et al.* 1980; Yarris 2010). Closer to our time, Earth apparently had a close encounter with a comet in the sixth century CE, causing the major climate changes, crop failures, famines, plagues, and devastation that sparked the Dark Ages (Schoch with McNally 2003). Indeed, we can document a series of comet events and solar outbursts occurring over thousands of years, and one such major event is recorded at roughly 3150 BCE (whether it was a comet impact or a solar outburst is uncertain), which coincides closely with the start of the Mayan calendar in 3114 BCE. Could the end of the Mayan calendar in 2012 CE mark the catastrophe that will bring our destruction? By my own calculations, based on the semiperiodicity of cometary bombardments in the past (see Schoch with McNally 2003), we might expect a major comet to intersect Earth's orbit around 2012 to 2025. However, as we now know, it is not just comets and asteroids that we should fear. The Sun itself could be the cause of a major catastrophe. Or perhaps a comet hitting the Sun could initiate a major solar outburst.

Clearly the Maya were dedicated and meticulous astronomers, and they developed (or possibly inherited) a sophisticated astronomy and calendrical system, the subtleties and nuances of which I suspect are still not fully understood or appreciated to this day. The Mayan astronomers would have certainly noted any unusual events in the skies, but unfortunately few Mayan texts and records have survived. One Mayan book that has come down to us is the Popol Vuh, the sacred Mayan book of creation (sometimes translated as "The Book of the People"), which survived only because the original Mayan hieroglyphic version (see Saravia 1984), now lost, was transcribed using the

Spanish alphabet in the sixteenth century (the Popol Vuh was still in the native language even after transcription). Members of the lineages that had once, before the Spanish incursion, ruled the region carried out this work in the town of Quiché, northwest of modern Guatemala City. Even their transcription survives only as a later copy. Between 1701 and 1703 the friar and priest Francisco Ximénez was able to study the manuscript. Fortunately he took the time to copy it and also provided a Spanish translation (Tedlock 1986, 27–30).

In the Popol Vuh are references to past creations and catastrophes, and some of the language is strongly suggestive of solar outbursts and associated phenomena. Dennis Tedlock provides this translation:

Again there comes a humiliation, destruction, and demolition. The manikins, woodcarvings [“the first numerous people here on the face of earth”] were killed when the Heart of Sky devised a flood for them. A great flood was made; it came down on the heads of the manikins, woodcarvings [that is, the people of the time] . . . they were killed, done in by a flood: There came a rain of resin from the sky. . . . The earth was blackened because of this; the black rain storm began, rain all day and rain all night. (Tedlock 1986, 84)

LaViolette (2009, 11) speculates that the Heart of Sky (which he refers to as the Heart of Heaven) might be a reference to the galactic core. I wonder if the “rain of resin” falling from the sky might reference powerful auroral displays and plasma phenomena as well as the dust, debris, and conflagrations that would accompany them. In particular, could the rain of resin be a description of the extraterrestrial dust and spherules jettisoned from the collapsing magnetosphere raining down onto Earth? (See discussion in chapter 7.)

In another section of the Popol Vuh we read:

And when the war befell the canyons and citadels, it was by means of their genius that the Lord Plumed Serpent and the Lord Cotuha blazed with power. Plumed Serpent became a true lord of genius:

On one occasion he would climb up to the sky; on another he would go down the road to Xilbalba [the underworld of Mayan mythology].

On another occasion he would be serpentine, becoming an actual serpent.

On yet another occasion he would make himself aquiline, and on another feline; he would become like an actual eagle or a jaguar in his appearance.

On another occasion it would be a pool of blood; he would become nothing but a pool of blood.

Truly his being was that of a lord of genius. All the other lords were fearful before him. The news spread; all the tribal lords heard about the existence of the lord of genius. (Tedlock 1986, 212–13)

This can be interpreted as auroral displays and plasma configurations, described as serpents, eagles, jaguars, and ultimately a pool of blood, morphing from one shape into another, as would actually be seen in the sky during a particularly powerful solar outburst. This description, although from a different cultural context (and by the time it was copied or recorded in final form it may have undergone some modifications, making it less purely descriptive of the natural phenomena it was originally based on), is remarkably similar to the descriptions of powerful auroral phenomena from the time of Ezekiel to modern times. It also fits the imagery of the ancient petroglyphs and the rongorongo script.

According to John Major Jenkins, who has studied Mayan cosmology intensively and in particular the cosmology relative to Mayan beliefs about the end of one "world age" after a time period of thirteen baktuns, "Each period ending in the Long Count, including all the various place value levels, were seen to be like-in-kind replays of the great period-ending event that occurs at the end of the 13-Baktun period. As such, the next 13-Baktun period-ending (in 2012) should be a big replay of the events described for 3114 BCE. That scenario involves the rebirth of the Sun Lord from the sky-earth cleft" (Jenkins 2006).

Furthermore, according to Jenkins, "The texts associated with these Creation monuments state that 'Creation happens at the Black Hole,' at 'the Crossroads,' and 'the image' will appear in the sky. At that time, a new Solar Age begins and the Sun Lord gets reborn" (Jenkins 2006).

Jenkins does not believe, however, that these Mayan references to the Sun and its rebirth are indicative of a catastrophic event such as a major solar outburst. His interpretation is very different, and he backs it up with both modern astronomy and direct interpretation of the Mayan texts and monuments.

Jenkins (2010) points out that on the solstice date of December 21, 2012 (the date when the path of the Sun reaches its lowest point below the celestial equator, marking the beginning of winter in the Northern Hemisphere), the Sun will be in alignment (as viewed from Earth) with the plane of our Milky Way galaxy, that is, the galactic equator (which in the sky is marked by a dark rift in the Milky Way). This point is essentially at the nuclear bulge of the galaxy, which in turn is very close to the galactic center or core. Thus the 2012 galactic alignment can be thought of loosely as the alignment of our Sun with the galactic center. As Jenkins himself points out, it is difficult to pinpoint precisely when the December solstice Sun will be precisely aligned with the galactic equator, and there is more or less an "alignment zone" some years or even a decade or more on either side of 2012 CE. However, the December solstice Sun is certainly not always involved in such an alignment.

Due to the phenomenon known as precession, the background stars in the sky slowly shift relative to the equatorial coordinate system used to map their positions. But this slow drift, generally attributed to a long-term "wobble" in the spin axis of Earth (although there are other explanations, such as the idea that our Sun has a companion star; see Cruttenden 2006), is very slow indeed, taking nearly twenty-six thousand years to complete a full cycle. Another way of saying this is that the position of the Sun on the December solstice (as well as on the June solstice and the equinoxes in March and September) slowly moves through the sky relative to the background stars, including the Milky Way. Thousands of years ago the December solstice Sun was well away from the Milky Way on one side, and thousands of years from now it will be well away on the other side of the Milky Way—again viewed from the perspective of an observer on Earth. Jenkins contends that the Mayan calendar was engineered to complete the thirteenth baktun, counting from the 3114 BCE beginning of the cycle, at the exact date of the December 2012 solstice galactic alignment. This certainly suggests some very sophisticated and precise astronomical observations and calculations.

But what is the significance of the galactic alignment? According to Jenkins (2010), the Maya believed that the 2012 galactic alignment would correspond to a great transformation on Earth. But this transformation is not to be found in the outer physical world, but rather the inner world, the soul. Jenkins summarizes this view by writing, "*2012 bodes a challenge and an opportunity for humanity*

to rebirth itself. Such a transformational rebirth can only be accomplished through sacrifice, sacrificing the illusions that bind us to states of suffering and limitation. We can reconnect with the higher source, our true selves, the centre and source of the world. This invitation is reflected in the galactic alignment, our Sun's rare alignment with the cosmic heart and source (symbolised by the galactic centre)" (Jenkins 2010; italics in the original).

Jenkins is certainly not the only person to suggest that the 2012 date may signify mental awakening and spiritual transformation rather than doomsday, as we transition to a higher level of consciousness. To take an extreme example, David Wilcock, who claims to be the reincarnation of the American psychic Edgar Cayce (1877–1945), has long suggested that some kind of spiritual or psychic transformation will take place in 2012. To quote from his website (you can also find there the "evidence" to support the contention that Wilcock is the reincarnated Cayce):

After the full completion of the Solar/Precessional/Galactic Cycle in late 2012, the Earth will no longer remain as a third-density planet. . . .

Together, we will clean, repair and renew the Earth with our newfound telekinetic abilities. One sweep of a hand will purify an entire polluted lake or river, or transform a festering garbage dump into rich soil. The crumbling ruins of city skyscrapers will sprout up into bold and beautiful trees, and the oceans will burst with fish, dolphins and whales.

Everyone will be telepathic, and no one will be able to hide anything from each other. Flying and psychic teleportation from one spot to another will also be possible, although we might not try to develop these abilities at first, not realizing that we now have them. . . . We will also regain membership in the Confederation of Planets in Service of the One Infinite Creator, our own "local" group in the Galaxy. This will give us the ability to travel among the stars and meet with other planetary cultures. . . .

Our neurological and spiritual capabilities will be so dramatically enhanced that it is not quite possible for us to really comprehend what it is going to feel like until we actually arrive there. The euphoria and bliss of day-to-day existence will be nearly fathomless in its depth. (Wilcock 1999/2009)

For some, this foreseen shift in consciousness may be associated with

physical global cataclysmic changes on Earth as well (see Joseph 2008). Spiritual enlightenment and physical catastrophes are not mutually exclusive! Wilcock notes, “The Earth will already have been cleansed from its magnetic pole shift/crustal displacement as the Grid realigns itself with the instreaming fourth-dimensional vibrations. This ‘pole shift’ will remove much of the traces of modern civilization from the Earth’s surface” (Wilcock 1999/2009).

For others, such as Jenkins, the shift will be much more subtle and related to more subtle cosmic events. As we have seen, due to the precession of the equinoxes, on the winter solstice of 2012 the rising Sun will be aligned with the galactic center of our galaxy. Scientific analysis has found that the relationship between the galactic center and Earth’s horizon relative to a person’s location on Earth affects cognitive performance and psychic abilities (see Bremseth 2008, as well as further discussion in chapter 14). Perhaps the 2012 galactic alignment could influence the general level of consciousness worldwide.

A shift in global consciousness is also indicated by the changing world ages. According to my analyses, using the vernal equinox as viewed from Egypt specifically, the transition from the Age of Pisces (an age of belief) to that of Aquarius (an age of knowledge) will occur around the year 2012. (“Belief ” and “Knowledge” are astrological keywords associated with Pisces and Aquarius, respectively.)

Or perhaps the 2012 shift in consciousness will be sparked by a message from another civilization. Some predict that extraterrestrials or otherworldly beings will reveal advanced knowledge to us lowly humans (see Wilcock 1999/2009, for instance). Others suggest the civilization we need to learn from is one that existed very long ago.

HALLS OF RECORDS: THE HAWARA LABYRINTH

How could an ancient civilization communicate with us today? They could have left messages in their myths and calendars (as the Maya may have done), they could have encoded them into the remains of temples and monuments (many a person has attempted to decode the Great Pyramid of Giza, Egypt, in a search for ancient knowledge; see Schoch and McNally 2005), or they could have left explicit records in a hidden and secure place.

Many writers have popularized the concept of a hall of records that stores the advanced knowledge of a long-lost civilization, be it that of Atlantis or some

other ancient culture of high achievements. The still-unopened chamber under the paws of the Great Sphinx that my colleagues and I found using seismic techniques has been hailed as just such a hall of records. But this is not the only possible location for a hall of records in Egypt. Enter the mystery of Hawara and the labyrinth.

In Greek mythology, Daedalus (known for crafting wings with which to fly) built a maze-like structure known as the Labyrinth on Crete to contain the Minotaur (part man, part bull). But the Cretan labyrinth was not the only one, or even the original labyrinth. Herodotus (fifth century BCE) and other Greek and Roman writers described a magnificent labyrinth in Egypt, containing three thousand rooms on two levels. Pliny the Elder (first century CE) related that the Egyptian labyrinth was already 3,600 years old in his time.

Since the nineteenth century, the Egyptian labyrinth has been identified with an area on the southern side of the Middle Kingdom mud-brick (originally sheathed with limestone) pyramid of Amenemhet III (late nineteenth century BCE) at Hawara. It was here that I traveled with an NBC crew in March 2009 to help shoot a television documentary.

What I found at Hawara, besides the pyramid, was an area of approximately seventy-five thousand square meters littered with the remains of pottery, human bones, fragments of stone sculptures, pieces of limestone and granite columns, and blocks of carved quartzite. Here some mighty structure once stood, but little remains. Much of the ancient labyrinth was pillaged thousands of years ago, during Ptolemaic and Roman times, as a ready source of building stone. Still, there are signs that something more might remain deeply buried in the ground. Recent geophysical studies by the Egyptian National Institute of Astronomy and Geophysics have suggested there are structures remaining to be discovered under the sands of Hawara.

To my dismay, there is now a canal running near the Hawara pyramid and right through the area of the labyrinth. I attempted to enter the pyramid, but before I could get very deep, the passage was entirely blocked by mud and water. I fear that whatever remains of the labyrinth, buried deep below the surface, is now also flooded by the elevated water table.

And what exactly was the Hawara labyrinth? One interpretation is that it contained and protected, in its maze of courtyards, passageways, and chambers (which Herodotus relates as being covered with inscriptions), the most important and sacred knowledge possessed by the Egyptians—knowledge possibly acquired from a still earlier civilization, perhaps one that had experienced cataclysmic events.

Does the core of the labyrinth remain, waiting to be uncovered? Perhaps it contains the knowledge we need as we face the uncertainty of the future. I just do not know, but I believe the Hawara labyrinth merits further exploration, and time is of the essence, but it is not the only place that a reputed hall of records may be located.

HALLS OF RECORDS: THE CHAMBER UNDER THE SPHINX

As I mentioned in chapter 2, back in the early 1990s geophysicist Thomas Dobecki and I carried out seismic surveys around and under the Sphinx to measure the depth of subsurface weathering (Dobecki and Schoch 1992). The depth of subsurface weathering confirmed my dating of the Sphinx, but we found more besides. Under the Sphinx are two major cavities or chambers and a tunnel-like feature. There is a cavity under the left rear haunch. Under the left front paw there is a large rectangular chamber. This chamber has received much attention for, as we discussed in chapter 2, the late, great American psychic Edgar Cayce predicted that a hall of records containing information from the lost civilization of Atlantis would be found in this area. Dobecki and I also found a tunnel-like structure running under and along the length of the body of the Sphinx, from the rear of the statue to the chamber under the left paw.

I believe the original Sphinx may have been a male African lion. Wildly speculating, perhaps the tunnel under the body represents an erect phallus, universally a potent symbol. In mating, the male lion mounts the female from behind, and we can envision this in the Lion-Sphinx. The seed of the phallus is directed toward the chamber, the hall of records, under the left paw. So how might we interpret this symbolism?

Imagine a highly advanced civilization, one that existed a very, very long time ago, but is now lost. Perhaps this primordial civilization seeded other civilizations, including the one that ultimately gave rise to us. But memories fade

quickly, especially in the formative years. How much does the typical adult recollect from his or her earliest years? This is why parents sometimes preserve baby books for their children—scrapbooks or memory books of precious photographs and mementos, the history of a child and the child's family and ancestry. As an act of love, did the founding civilization put together a scrapbook for its children? For future civilizations to come? For us? Is this the prophesied hall of records, under the left paw of the Sphinx? And why the left paw? The heart is on the left. Perhaps there is a correlation here, one of love.

If the Lion-Sphinx seeded our civilization and protects our memory book, it may also encode further secrets. The Lion-Sphinx, carved of stone in times immemorial, is aligned with the cosmos and perhaps points to a location in the heavens. In the night sky the lion is Leo. Astrologically, the Sun is the ruler of Leo, and Leo rules the heart. Regulus, the most regal of the Royal Stars, the star of honor and dignity, is at the breast and heart of Leo. The Lion-Sphinx faces due east, and on the vernal equinox in about 9000 BCE the Sun was in conjunction with Regulus and Venus (representing, among other things, love), and they all rose together that morning as the Lion-Sphinx faced the rising Sun. What is the Lion-Sphinx telling us? Should we look toward Regulus for answers? Does Regulus in the sky correspond to the chamber, the hall of records, our ancestry, humanity's inheritance?

Perhaps I am venturing into dangerous territory. As an individual with a curious mind, I can entertain outrageous scenarios. But as a scientist, I must stick with the data, and so I go no further.

HOW ACCURATE IS THE MAYAN CALENDAR?

An issue that must be addressed is whether the Mayan calendar has been accurately correlated with the modern Gregorian calendar. Does the last day of the thirteenth baktun really correspond to December 21, 2012? The most commonly used correlation today, which is the one that comes up with the December 21, 2012, end date, is known as the GMT correlation, named after the initials of the three researchers involved: Joseph Goodman, Juan Martinez-Hernandez, and John Eric Sydney Thompson. This standard correlation dates

back to the first third of the twentieth century. The GMT correlation is linked to astronomical events recorded by the Maya, and when precisely these events occurred, as a way to synchronize the Mayan and modern Gregorian calendars. If the astronomical events are misdated or misidentified, then the correla tion is called into question (O'Neill 2010).

Gerardo Aldana, associate professor at the University of California, Santa Barbara, has his doubts about the GMT correlation; in particular he questions the accuracy of modern interpretations of some of the Mayan astronomical observations (Physorg.com 2011b; *Santa Barbara Independent* 2010; Heussner 2010). For instance, in one case a certain Mayan reference has generally been assumed to refer to the planet Venus (one aspect of the Mayan calendar relied heavily on the cycles of Venus), but it may in fact refer to a meteor. If such is the case, it throws the standard GMT correlation into doubt. Aldana points out a number of reasons why the GMT correlation may not be accurate, although he does not propose a new correlation. If the standard correlation is off (although it is not yet proven that this is the case; Jenkins [2011] presents strong evidence supporting the GMT correlation), then how much off might it be? How inaccurate might the December 21, 2012, date be? Possibly it is off only on the order of sixty days (O'Neill 2010), or possibly it is off by even a century (Longo 2010). For some this possible inaccuracy in the Mayan calendar correlation will serve as an excuse and rationale to dismiss the entire "2012 issue" as New Age nonsense. In my opinion it is a nonissue since I have never taken the precise date, or year, as definitive. Rather, as I explained at the beginning of this chapter for me the significance of 2012 is that something will happen! Whether the catastrophe hits in 2012, 2025, or 2050, we would do well to be prepared.

2012 IN NEW ZEALAND AND ELSEWHERE

Lawrence E. Joseph (2008, 211) relates a Maori (New Zealand) legend that supposedly includes the date of 2012. Rangi (the Sky) and Papa (the Earth) will in the future come back together, and in the process will hold each other so tight that their children (humanity) will be caught between them. The children, after struggling mightily to push Rangi and Papa apart, will quarrel and bicker among themselves. Ultimately the fighting will consume the children, and Rangi and Papa will reunite once again, destroying humanity and everything else that gets crushed between them. Just before this final destruction, however, a canoe will come down from the heavens to save those few people who are spiritually

deserving.

And when will this coming together of the Sky and the Earth happen? Lo and behold, the Maori elders (who refused to go on record, but passed the knowledge on to Joseph) state it will begin in 2012. But, and it is a big but, it is not at all clear that this legend is really of an ancient and indigenous origin. According to Joseph, “A number of Maori myths and legends turn out to have been created in the early nineteenth century by Western anthropologists who visited New Zealand and either grossly misconstrued or outright invented ersatz tales that were gradually incorporated into Maori lore” (Joseph 2008, 211).

Generations later such stories have become interwoven with the pre-contact cultural attributes, and it can be difficult or impossible to tease out what is original. This is a problem around the world when attempting to collect “ancient” traditions supposedly passed down from generation to generation verbally and now revealed to the too-often gullible Westerner by the eager-to-please “elder,” “wisdom keeper,” “shaman,” or the like (who often expects, or even demands, some form of remuneration in exchange for imparting her or his knowledge). In the case of the Maori legend, I have a difficult time believing that they independently came up with the date of 2012, or anything even close to such a date.

The Hopis and Cherokees, being native North American peoples who could easily have been influenced by their brothers and sisters to the south in Mesoamerica, are another matter. However, I remain skeptical that their stories of either an end to the world as we know it or our emergence into a new world age in 2012 (and some say precisely on December 21, 2012) are anything more than modern New Age hubbub infiltrating the native lore, although there are apparently genuine indigenous legends of world ages—even if not necessarily mentioning 2012—among these groups (Heinberg 1989). My feeling is the same about the Q’ero Indians of Peru. Supposedly their lore states that time itself will cease in 2012 (Joseph 2008, 210), but then perhaps they did share this notion, or at least the 2012 date, with the Maya in pre-Columbian times. At this point we just do not know, but I would not put a lot of stock in it.

What I do put a lot of stock in is that the ancients were neither stupid nor ignorant. They knew things that we no longer know. They had an understanding

and awareness of the cosmos that we have either forgotten or lost. I believe there is something genuine in the concept of ancient wisdom, something that perhaps is just beginning to be rediscovered by a few scientists, philosophers, scholars, and visionaries of the modern world. Let us now turn our attention to some cutting-edge developments in science that may shed light on the ancient mysteries.

14

ANCIENT WISDOM, NEW DISCOVERIES, AND NEW SCIENCE

According to ancient and traditional teachings—the perennial wisdom—we ("we" as individuals, "we" in terms of humanity, and "we" in the sense of life as a whole) are an intimate part of the universe. We are not isolated from each other or from Earth and the cosmos. We are connected; we are tethered to the cosmos. This simple yet profound notion, ultimately, is the essence of much ancient wisdom; it is the core message of the sages of old. The microcosm and the macrocosm are reflections of each other and united at the most fundamental level. The Hermetic teachings proclaim, "As is the Inner so is the Outer; as is the Great so is the Small; as it is Above, so it is Below: there is but one Life and Law" (Hermetic postulate, as quoted by Bowen [1936?], 31).

Another common ancient tradition, found across many cultures worldwide, is that of cycles of time, life, and humanity (Godwin 2010; Selbie and Steinmetz 2010). This is expressed in various ways: the concept of the Golden, Silver, Bronze, and Iron Ages; the Yuga Cycle of Hindu traditions; or the zodiacal precessional ages. Two key points of this ancient teaching must be emphasized:

These cycles materially, mentally, and spiritually impact humanity; that is, we are not immune to the larger influences of nature and the cosmos.

There have been other ages, and there will be more in the future, some better and some worse than the present age. Indeed, ancient traditions agree that we are currently far from a "golden age" (Heinberg 1989); rather, most such traditions would place us in an age of coarse materialism with diminished mental and psychic abilities and a lack of understanding of that which is genuinely important.

Modern science, and society at large, has often downplayed or outright dismissed such ancient traditions. The individual has been viewed as supreme, inviolate, and isolated from other individuals. Many "modern and educated" people believe that the thoughts in one's own head, if not acted on physically, stay in one's head. That is, psychic phenomena such as telepathy (direct mind-to-mind interactions without the use of the normal senses) do not and cannot occur, despite the overwhelming evidence to the contrary (see Bem 2011; Bremseth 2008; Burns 2003; de Martino 1972; de Vesme 1931a, 1931b; Laszlo 2003, 2004; Myers 1903; Owen with Sparrow 1976; Utts, 1991; Schoch and Yonavjak, 2008). Likewise, many members of society today consider these times, with our modern sophisticated technology, to be the height of civilization. For them it is nonsense to think that any society or people of antiquity could have been in any way more knowledgeable than we, at least collectively, are today (whether it be technological knowledge, philosophical insight, religious revelation, or mental and psychical abilities). Even more ridiculous, according to such thinking, is the notion that we are somehow linked to the cosmos and subject to cycles, ebbs, and flows beyond our control. It often seems to me that the hubris of modern society knows no bounds.

As we have seen already, Earth (and therefore we creatures on Earth) is very much subject to the vagaries of our Sun, and more generally our galaxy and universe. But it is not just on the macroscopic and materialistic scales that we are tied, tethered, to our Sun, solar system, galaxy, and cosmos. There is evidence that at an even deeper level the macrocosm impacts directly the microcosm. Unbeknownst to the average person, or even the average scientist, new discoveries are being made in both the physical and biological sciences, discoveries that stand to upend the very foundations of modern conventional ways of thinking. These new findings confirm the truth of both mystical revelations and the tenets of ancient wisdom, that we are inescapably linked to each other and to larger cycles that we as yet cannot fully comprehend. Let's take a look at some major discoveries.

BREAKING UP THE PARTY: THE NONCONSTANCY OF RADIOACTIVE DECAY

Certain forms of atoms, known as isotopes, are inherently unstable and are said

to undergo radioactive decay when they spontaneously break down into smaller constituent particles. The instability of a radioactive isotope is due to too many particles (protons and neutrons) being squeezed into the center of the atom (the nucleus) when it was originally formed, either at the time of the origin of the known material universe or subsequently, such as when elements are synthesized in the center of a star or form from colliding particles during a supernova explosion. Think of a holiday party in a small apartment with too many friends packed into a confined space. As much as everyone might initially enjoy the gathering, over time the situation becomes uncomfortable, with elbows poking into ribs, voices forming a cacophonous chorus that drowns out any individual conversation, and then even misunderstandings and hard feelings possibly arising. Eventually the party breaks up as individuals and small groups split off. The party disintegrates. Likewise, from the crowded center of a radioactive isotope, eventually individual particles and/or groups of particles are ejected (collectively known as the radiation given off by a radioactive isotope). How quickly the party ends, how quickly a given sample of a radioactive isotope breaks down, is commonly expressed in terms of the half-life (how long it takes for half of any sample to disintegrate) or decay rate (the longer the half-life, the lower the decay rate). For instance, radioactive plutonium-239 (^{239}Pu) has a half-life of approximately twenty-four thousand years, and radioactive carbon-14 (^{14}C) has a half-life of approximately 5,730 years.

Radioactive isotopes are more common, and thus of more profound importance, than many people realize. They are found not only in atomic bombs and nuclear power plants, but they also occur dispersed throughout the entire Earth and universe. Every living being and every material object contains some percentage of radioactive isotopes. A fundamental principle of modern nuclear physics is that the radioactive decay rate for any particular unstable isotope of an element is constant. This is the case whether the decay rate is based on a traditional experimental approach or calculated using the equations of quantum mechanics.

This constant decay rate is, according to establishment science, truly constant under all conditions and is independent of temperature, pressure, chemical environment, and so forth. (Established science does acknowledge a few exceptions to the general rule of constant decay rates, but they involve only certain types of radioactive decay when the atoms are subjected to, for instance,

extremely strong electric fields, and these exceptions do not invalidate the general analysis discussed here.) Indeed, assuming the inviolate nature of decay rate constants, radioactive isotope decay has become a standard method of dating both geological specimens and archaeological artifacts. Carbon-14 (radiocarbon) dating is now one of the most commonly used methods to date everything from fragments of burned charcoal in a Late Stone Age fireplace to Egyptian mummies.

To question the presumed constancy of such constants as decay rates could not only suggest "that decades of established science is flawed" (Cartwright 2008), but could also call into question the absolute time frame, in terms of years into the past, of prehistory, and even of Earth and cosmic history. We might be forced to not only rethink our science, but to rethink our history as well.

In August 2008, physicists Jere Jenkins and Ephraim Fischbach, of Purdue University, burst on the scene with an incredible claim. Decay constants are not so constant! Through detailed analysis, they found that the decay rate of radioactive manganese-54 (^{54}Mn) fluctuates in correlation with solar flares (Jenkins and Fischbach 2008). And that was not all. It was also found that the decay rates of radioactive silicon-32 (^{32}Si) and radioactive radium-226 (^{226}Ra) vary over time and that the variations correlate with the changing distance between the Earth and the Sun (Jenkins *et al.* 2008). When the Earth is closest to the Sun (in January), the decay rate increases; when the Earth is farthest from the Sun (in July), the decay rate decreases.

These are incredible, absolutely astounding results with profound ramifications. Not only should decay rates be constant, according to conventional physics, but also if there is any inconstancy found, it should certainly not be due to solar flares or something as subtle as the changing distance between the Earth and the Sun. This would be the equivalent of suggesting that how quickly a holiday gathering in New York disperses is a function of how crowded the vegetable markets are in Shanghai.

Celestial mechanics influencing fundamental physical processes on the surface of Earth! According to conventional wisdom, this is the stuff of medieval thinking, superstition, and astrology—wrongheaded and ignorant notions that were dismissed long ago. Either the data on varying decay rates are wrong or

conventional establishment science is flawed. The stakes could not be higher. Thus, it is not surprising that the work of Jenkins, Fischbach, and colleagues is finding a cold reception among many mainstream physicists, not because the data and analysis can be refuted, but because they threaten conventional thinking and worldviews. As physicsworld.com reporter Jon Cartwright wrote, "As more scientists hear about the claimed relation of decay constants to solar activity, reactions vary from disbelief to rejection. 'I don't understand this at all, what it could possibly be,' says John Barrow of Cambridge University. 'It's a gigantic effect. . . . It sounds as though it's related [to solar activity], but it really can't be'" (Cartwright 2008; material in brackets in the original article).

Why is it that "it really can't be"? Perhaps because it would overturn some of conventional scientists' most cherished notions about the world and universe and force them to rethink much of what they think they know.

Even more dismissive is David Wark of Imperial College London: "If a student brought this to me I would advise them to understand their experiment before they start coming up with wild correlations of detector noise with natural phenomena picked at random" (Wark, quoted in Cartwright 2008).

The data used by Jenkins, Fischbach, and colleagues span some five years and fifteen years for silicon-32 and radium-226, respectively, and for these periods of time consistently, without exception, the data correlate with the orbit of Earth around the Sun. Jenkins, Fischbach, and colleagues even calculate formal probabilities that the correlations could be simply due to chance, with the result that the odds are astronomically low (6×10^{-18} and 1×10^{-29} for the respective data sets). Yet someone like Wark feels smug in publicly dismissing the data as "detector noise" that somehow just happens to appear to correlate with a fundamental natural phenomenon.

The work of Jenkins, Fischbach, and colleagues demonstrates a connection between one of the most fundamental processes known in physics, namely nuclear decay rates (which should, according to conventional science, be a result of quantum processes in the nucleus and unaffected by the external macroscopic world), and a very subtle cosmic influence, namely the orbit of the Earth around the Sun. Perhaps it is justifiable to question, and possibly even dismiss without more corroborative analysis, the radical implications of this work. But there are

more data from a very different line of studies spanning over four decades that in fact support the findings of Jenkins, Fischbach, and colleagues.

TEETH ON THE BELL CURVE: DISCREPANCIES IN BASIC NATURAL PROCESSES

In 1998 the Russian biophysicist Simon E. Shnoll, of Moscow State University, and his colleagues published a groundbreaking paper (Shnoll *et al.* 1998; see also Shnoll 2006 and Tennenbaum 2000) summarizing forty years of detailed investigations into fundamental physical, chemical, and biological processes. Despite being published in a prominent Russian physics journal and also being translated into English, the work of Shnoll and colleagues has been largely ignored, perhaps because, if true, the implications are radical and far-reaching. Like the findings of Jenkins, Fischbach, and colleagues on varying radioactive decay rates, the work of Shnoll and his colleagues undermines the very foundations of much of modern science and has profound implications bearing on the nature of the universe, reality, and our place in the cosmos. Again, this is material that conventional scientists are, at first glance, inclined to dismiss as nonsense, but the data have been corroborated over and over again throughout many decades.

Shnoll and colleagues have studied the statistical distribution of the fluctuations in the decay rates of numerous radioactive isotopes as well as statistical variations in the rates of reaction of various different types of physical, chemical, and biological processes. These so-called fine structures of the decay rates and other processes, plotted as graphs, show a spread or scatter of data that by conventional established science is normally considered noise in the measurements, something to be eliminated or simply ignored rather than studied.

Think of a standard bell curve, then give it a jagged edge. By conventional thinking, as more and more measurements are taken of natural physical, chemical, and biological processes, the scatter or “roughness” (the jagged edge) of the data will decrease. When plotted using standard techniques, the data will fall on a smooth bell-shaped curve. However, putting conventional thinking to the test, Shnoll and colleagues have consistently found that more and better data of the natural processes they have studied do not smooth out the supposed noise, but rather definite patterns in the fine structure emerge. The curve that should,

according to conventional science, be smooth is in fact rough. Picture the curve as having serrations or teeth on its surface, and furthermore, as more data are collected, the serrations become more distinct and pronounced. There is something going on here. There is a message in the fine structure, if only we can figure out what it says. Imagine a roulette wheel. Give it a spin, and any number on its face should have an equal chance of coming up. If certain numbers consistently appear more often than they should, we logically conclude it is not a fair wheel. Something is influencing it. Someone has tipped the roulette wheel toward certain numbers. Likewise, the work of Shnoll and his colleagues indicates that something unaccounted for by modern conventional science is influencing basic natural processes at the most fundamental level.

The implications of Shnoll's findings are profound. They call into question the entire concept of randomness in natural processes as currently understood by science and in particular as predicted by quantum physicists (see Tennenbaum 2000). The Shnoll findings indicate that modern conventional science does not fully understand the most basic natural processes and what subtle factors may influence them.

But the work of Shnoll and colleagues does not stop with simply finding consistent and repeatable patterns in the fine structures of various processes. Amazingly, the fine structures of very different and incredibly diverse processes have been found to correspond in their patterns when measured simultaneously, even at entirely different laboratories located at large geographic distances from one another. For instance, the beta activity of hydrogen-3 (^{3}H), the beta activity of carbon-14 (^{14}C), the alpha activity of plutonium-239 (^{239}Pu), the reaction rate of ascorbic acid and dichlorophenolindophenol, and the reaction time of water protons all showed similar fine structures (similar jagged edges) when measured simultaneously, yet the measurements were made in different contexts using different techniques. The last sentence may sound overwhelming to the uninitiated, but to put it into a more human context, ascorbic acid is commonly known as vitamin C, and how quickly it reacts is fundamental to human physiology (as well as that of many other organisms). Plutonium-239 atoms are highly radioactive, extremely deadly, and found in certain types of atomic bombs and nuclear power plants. Carbon-14 is found in all organisms, and it, like hydrogen-3 and protons in water, is scattered throughout Earth and indeed the known universe. Somehow, as amazing at it may appear, there are

connections, or at least correlations, between the fundamental natural processes in us, plutonium-239 in a nuclear reactor, and protons in the water of the world's oceans.

Conventional establishment science has no cogent explanation for such connections, and indeed the standard way of dealing with such claims is to simply dismiss or ignore them out of hand. It is as if two identical roulette wheels, one in New York and another in Paris, were spun simultaneously and independently of each other, but each time they both came up with the same distribution of numbers. To make the analogy even more accurate, assume that the two roulette wheels are made out of different materials and are spun by different means (representing different processes), yet they still come up with the same results. The work of Shnoll and colleagues has been repeated and repeated over and over for many decades. It is robust and must no longer be ignored.

Perhaps the most important, puzzling, and profound aspect of the work of Shnoll and colleagues is that they have found that the fine structures of the processes they have studied vary consistently in correlation with astronomical cycles. This supports the work of Jenkins, Fischbach, and colleagues, but takes it even further. Shnoll and his colleagues have found periodicities in the fine structures that correspond to both the solar day (1,440 minutes) and the sidereal day (1,436 minutes; the time it takes Earth to make one full turn on its axis relative to the fixed stars rather than the Sun). They have also found periodicities of 27.3 days (corresponding to the sidereal month, the time it takes the Moon to return to the same position among the stars) and 365.25 days (the yearly cycle).

The reason behind these correlations is obscure, but clearly it has something to do with more than just local effects. In this context, local can be defined as within our solar system. Correlations of fine structures with the sidereal day and the sidereal month clearly indicate cosmological factors beyond our local solar system. This should not be the case according to conventional established science. As D. S. Chernavskii, editor of *Physics-Uspekhi,* in which the Shnoll *et al.* (1998) paper was published, commented, "It is demonstrated that the fine structures of histograms for quite diverse random processes (physical, chemical, biological, etc.) are similar and vary in sympathy. Moreover, these periodical changes correlate with the changes in our solar system, and possibly in our universe" (Chernavskii 1998, 1035).

Such findings appear to confirm, with new science, the ancient maxim, "As

above, so below."

FLUCTUATING FIELDS: CONSCIOUSNESS AND THE COSMOS

It is not just physico-biological processes at the atomic and subatomic levels that are correlated with astronomical processes, but mental processes as well. The evidence is overwhelming that certain paranormal phenomena, such as spontaneous instances of telepathy are real (see Bem 2011; Bremseth 2008; Burns 2003; de Vesme 1931a, 1931b; Laszlo 2003, 2004; Myers 1903; Owen with Sparrow 1976; Utts 1991; Schoch and Yonavjak 2008). Detailed analysis has demonstrated that spontaneous cases of such mental phenomena as telepathy and clairvoyance are correlated with geomagnetic fluctuations (Wilkinson and Gauld 1993). This is very interesting on numerous accounts. If telepathy and similar phenomena were not real, but rather a result of fraud and deception (including naïve self-deception), there is no reason to believe that reported incidences would correlate with the changing geomagnetic flux. Furthermore, the geomagnetic flux is affected by many parameters, not least of which are astronomical and cosmic factors (Mackey 2007).

Additionally, it has been found that paranormal mental phenomena are correlated with local sidereal time, which in turn is a function of one's relationship to the center of our galaxy (Bremseth 2008). These types of data clearly demonstrate that mental activity and states of consciousness are correlated with cosmic factors. Again, the lesson is that we are connected in a most profound way with each other and the universe at large. This lesson applies whether one adopts a strict reductionism attitude (the belief that the mind is simply a function of the processes taking place in the material brain) or a dualism approach (the mind is, to at least some degree, independent of the material brain, but the brain may act as a filter for sensory and other input to the mind). Either way, the mind and consciousness, as well as the fundamental workings of physical, chemical, and biological processes in the material brain, are inextricably tethered to the larger world.

Plate 1. Catherine Ulissey and Robert Schoch standing next to a moai at Rano Raraku, Easter Island, January 2010.

Plate 2. The Great Sphinx of Egypt, with the ruins of the Sphinx Temple in the foreground and the Pyramid of Khafre in the background. Photograph taken by R. Schoch in the early 1990s.

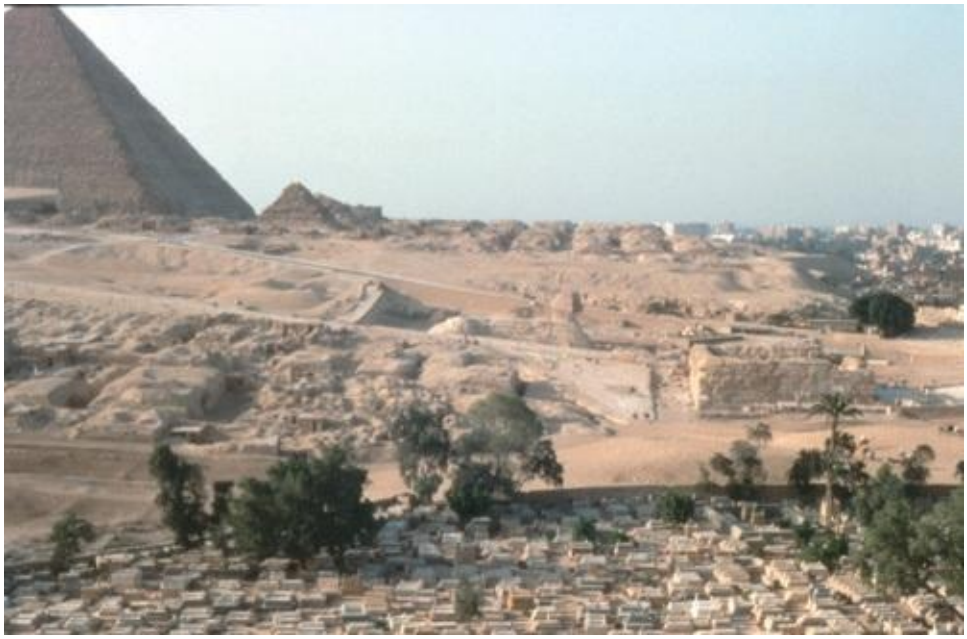


Plate 3. A side view of the east-facing Great Sphinx seen from the south, with a portion of the Great Pyramid in the background. Photograph taken by R. Schoch in the early 1990s.

Plate 4. Early 1990s photograph of John Anthony West (left) and Robert Schoch (right) standing in front of the Great Sphinx.

Plate 5. Early dynastic mud-brick mastabas, circa 2800 BCE, on the Saqqara Plateau. In the background is the Pyramid of Djoser (Zoser). Photograph taken by R. Schoch in the early 1990s.

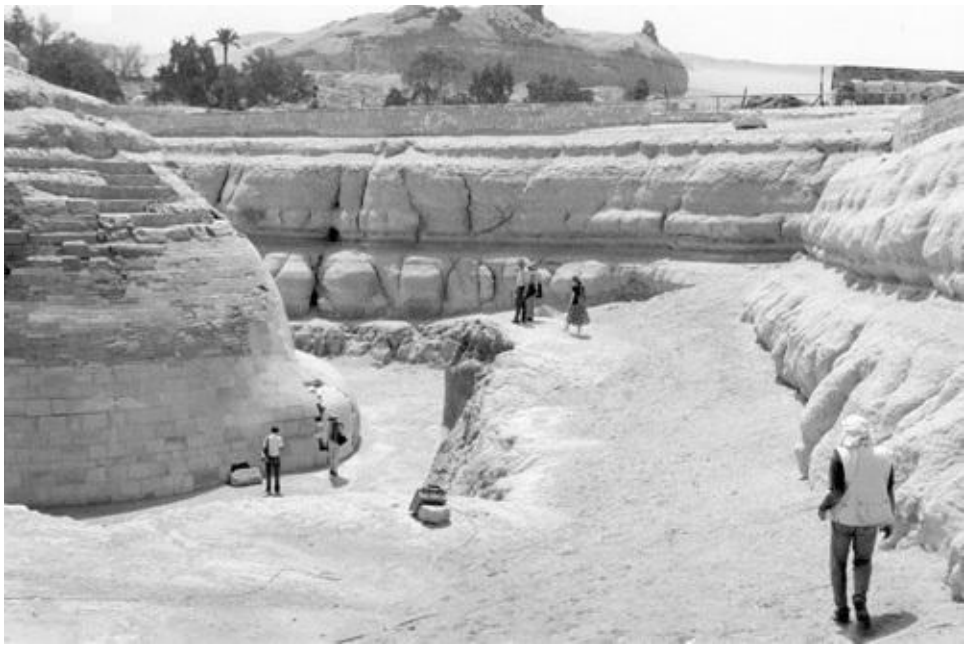


Plate 6. View of the western end of the Sphinx Enclosure; the rear of the Sphinx is seen on the left and the two-tiered western wall on the right. Photograph taken by R. Schoch in the early 1990s.

Plate 7. Precipitation-induced (rain) weathering and erosion on the southern wall of the Sphinx Enclosure.

Plate 8. Wind-induced weathering and erosion on Old Kingdom tombs, Giza Plateau. Photograph taken by R. Schoch in the early 1990s.

Plate 9. Overview of Göbekli Tepe, looking toward the south.

Plate 10. View of Enclosure D at Göbekli Tepe, looking toward the southwest.

Plate 11. Panoramic view (produced from a composite of several photos) of Göbekli Tepe looking toward the northwest corner.

Plate 12. Enclosure C, pillars and details.

Plate 13. Various views of pillars at Göbekli Tepe.

Plate 14. The statue of a man found in Urfa that is believed to date back to the general time of Göbekli Tepe (left). Robert Schoch beside the same exhibit at the Museum of anlıurfa (right).

Plate 15. Details of pillars at Göbekli Tepe.

Plate 16. Pillar in Enclosure D of Göbekli Tepe.

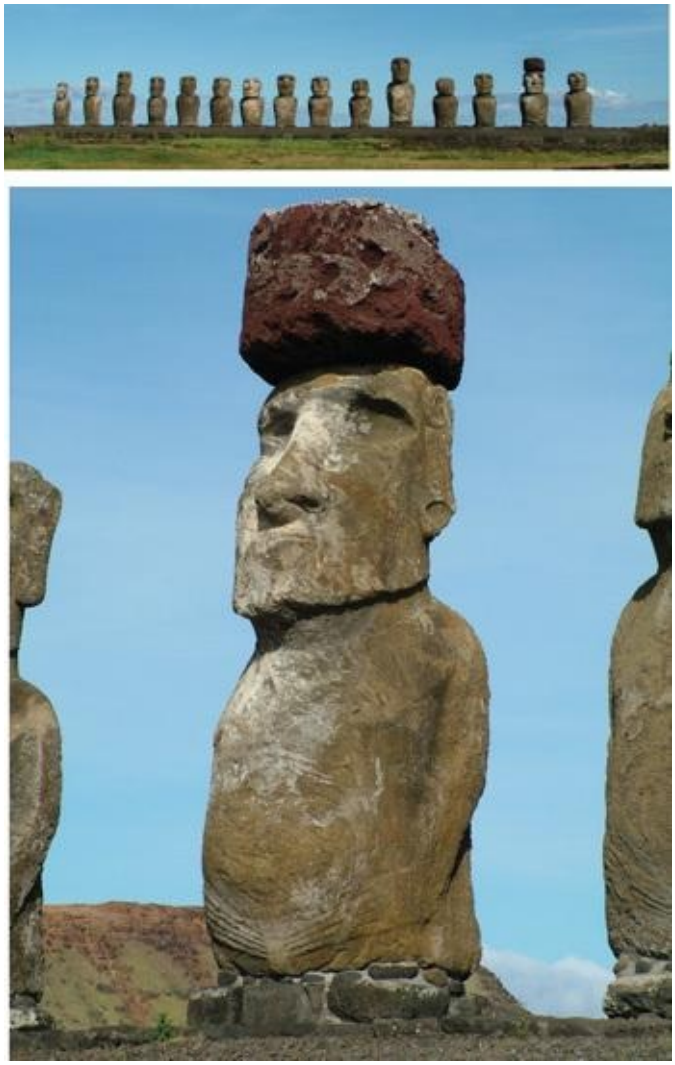


Plate 17. Close-up and distance view of moai on Ahu Tongariki, Easter Island.

Plate 18. Stone structures at Orongo, Easter Island.

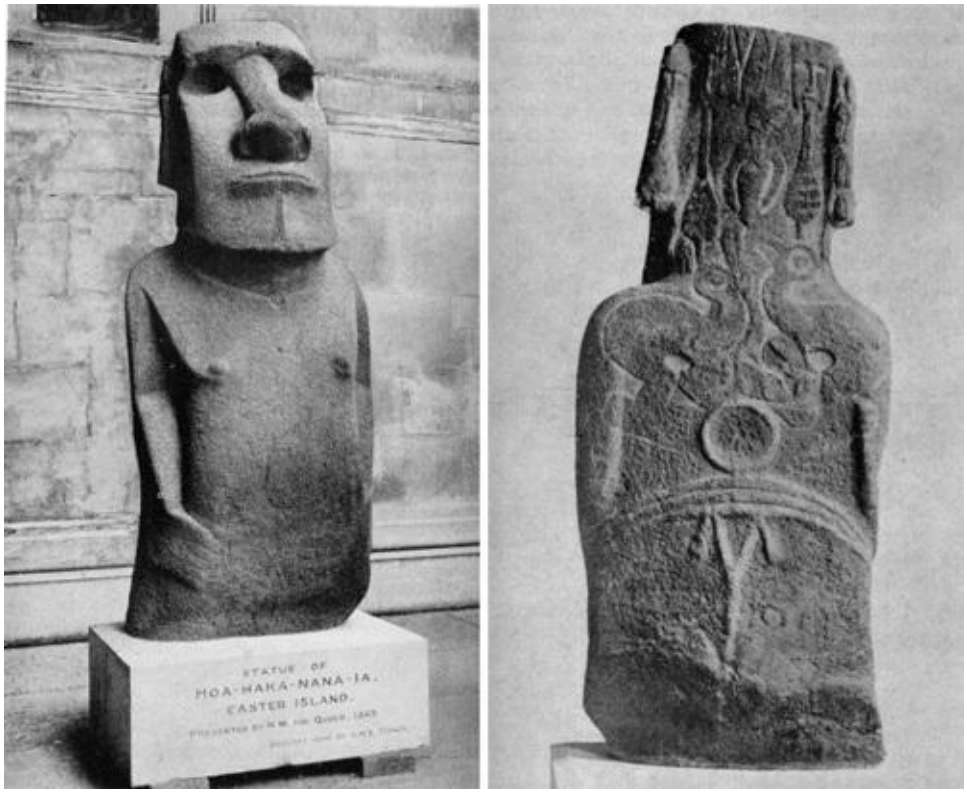


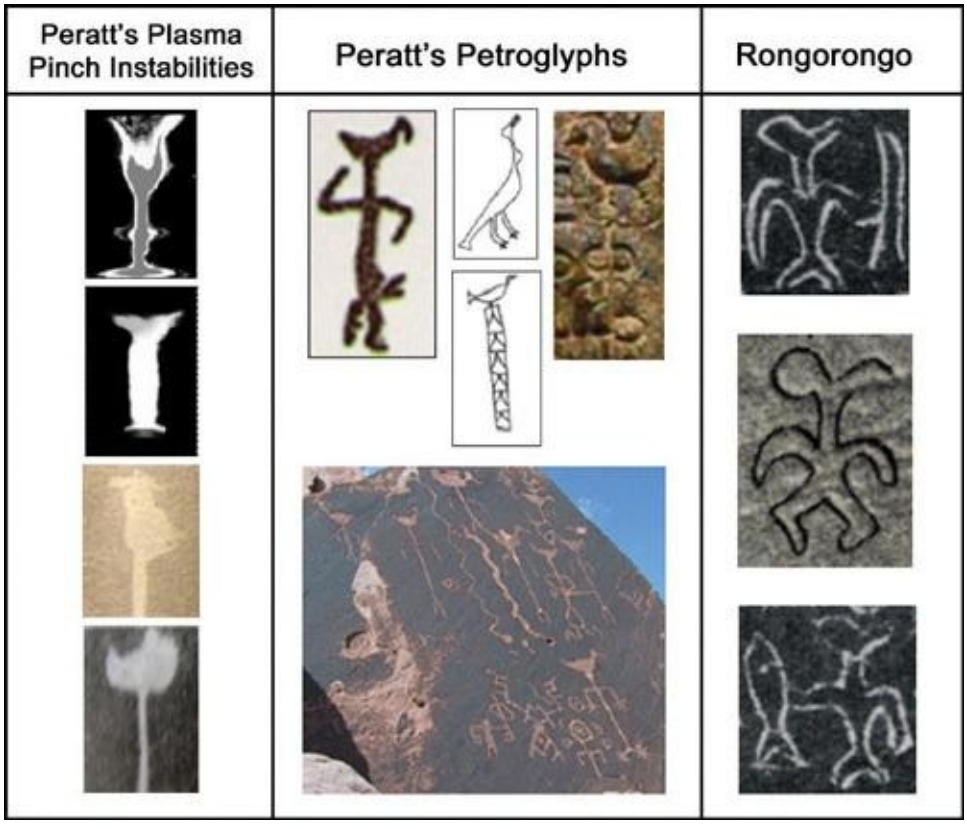
Plate 19. Front and rear view of a basalt moai from Easter Island now in the British Museum, London. (Photographs from Routledge, 1919, figures 31 and 106.)

Plate 20. Rongorongo tablet. (Photograph from Thomson, 1891, plate XL.)

Plate 21. Unfinished moai (horizontal) in the background in the quarry at Rano Raraku, with various erected and buried moai (only the tops of their heads and faces showing) in the foreground, Easter Island.

Plate 22. Partially excavated moai at Rano Raraku, Easter Island. (Photograph from Routledge, 1919, figure 72.)

Plate 23. Female moai carved of basalt and now housed in the museum on Easter Island.



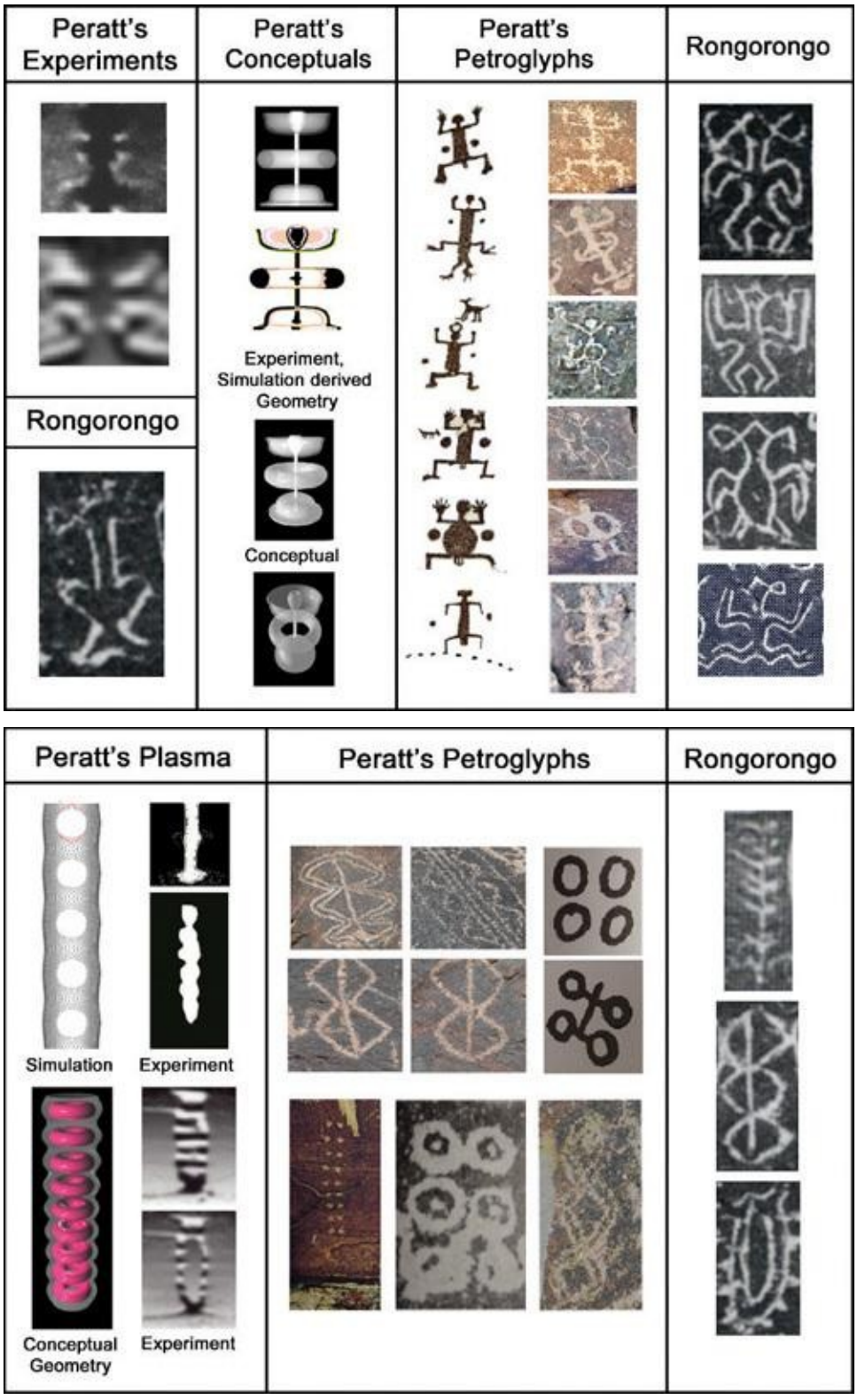


Plate 24. Comparisons of plasma configurations, petroglyphs, and rongorongo glyphs. (Plasma and petroglyph illustrations courtesy of Dr. Anthony L. Peratt, reprinted with permission from *IEEE Transactions on Plasma Science*,

December 2003, vol. 31.)

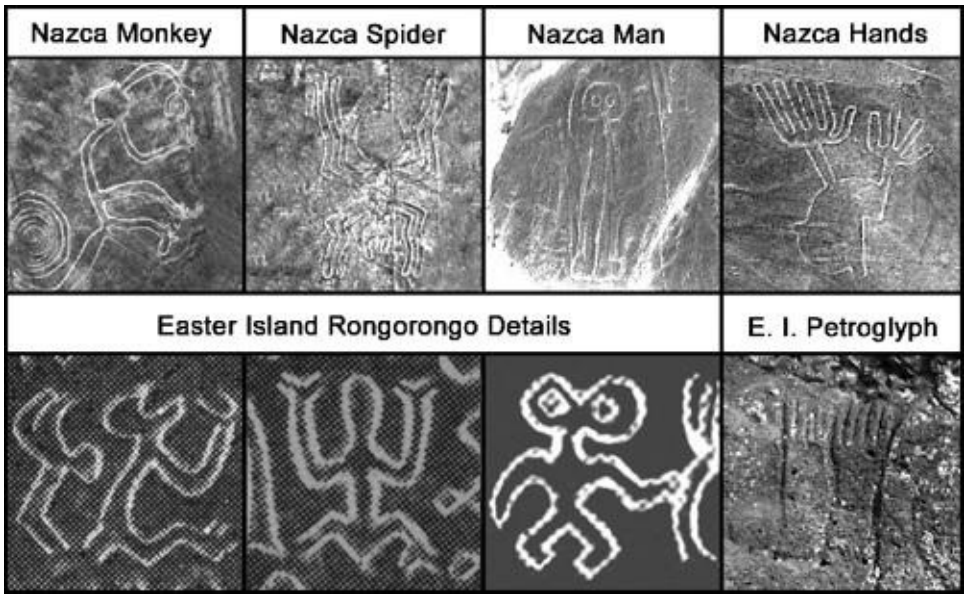


Plate 25. Nazca geoglyphs compared to rongorongo glyphs and an Easter Island petroglyph.

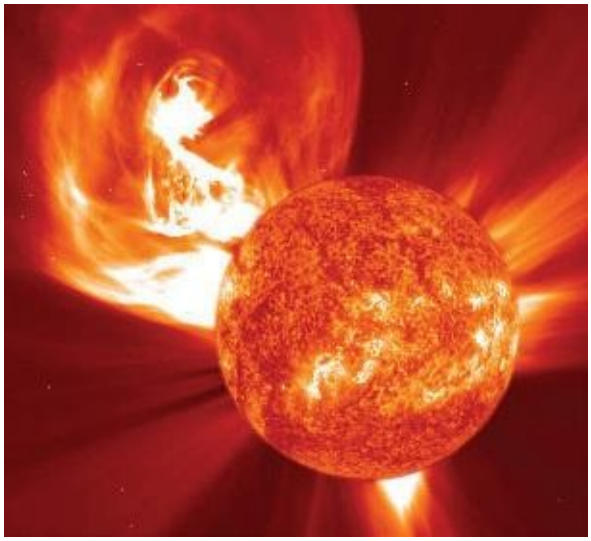


Plate 26. Composite image of a Coronal Mass Ejection (CME) from the Sun. (Courtesy of Solar and Heliospheric Observatory, European Space Agency and National Aeronautics and Space Administration.)

Plate 27. Example of vitrified rock found in the walls of the Mote of Mark, Scotland. Specimen approximately 12 cm across.

Plate 28. Comparison of an Easter Island petroglyph and an Easter Island rongorongo glyph (Thomson, 1891) to carvings at Göbekli Tepe. (Photograph of Göbekli Tepe pillar courtesy of Berthold Steinhilber, 2008.)

Plate 29. The Aurora Borealis, or Northern Lights, seen from Eielson Air ForceBase, Alaska. (Photograph courtesy of U. S. Air Force, Joshua Strang,

photographer.)

ELFS: TUNING INTO THE EARTH

Another manner by which we are connected to each other and to the Earth at large is through extremely low-frequency (commonly referred to as ELF) electromagnetic waves. ELF waves are part of a continuum from very-high-frequency waves, such as gamma rays and X rays (with frequencies of over 10^{16} Hz [hertz; cycles or beats per second], that is a 1 followed by sixteen zeros!) through visible light (frequencies in the range of around 5×10^{14} Hz) to radio waves (frequencies below about 10^{11} Hz). ELF waves have frequencies on the order of only a few hundred Hz to less than 1 Hz (in some cases, ultra low-frequency [ULF] waves with frequencies below about 3 Hz are distinguished). Human brain wave activity falls within the ELF range, and it is now known that ELF waves can influence human electrophysiological signals (Cosic *et al.* 2006). The natural resonance of electromagnetic waves oscillating between the surface of Earth and the ionosphere peaks at various frequencies around 7.8, 14, 21, 26, 33, and 39 Hz (see Farmer and Hannan 2003; and Bliokh *et al.* 1980). These resonance frequencies, known as Schumann resonances, correlate with brain wave frequencies, and indeed humans can synchronize their own brains and consciousness with the Schumann frequencies (Hainsworth 1983; Miller and Miller 2003). On a personal note, I have found that sometimes I unconsciously shake my leg or tap my finger; crudely measuring the frequency of such movements, they are generally in the range of 3.8 to 4.0 Hz, that is, in harmony with Schumann resonances.

In deep mediation, slowing down the dominant brain wave frequency to synchronize and resonate with the dominant Schumann frequency of about 7.8 Hz allows the individual to tap into what might be referred to as the planetary frequency, or natural Earth frequency. Thus we can harmonize with the inherent rhythm of both our physical world (“breathing with the Earth,” as expressed in Becker and Selden 1985, 243) and the global biosphere, including other conscious beings (human and nonhuman). In such a state, synchronized with the natural 7.8 Hz Schumann resonance of Earth, all the phenomena associated with theta waves (brain waves around 4 to 8 Hz that occur during deep meditation), such as expanded consciousness and insight, are manifested—plus, types of extrasensory experiences (for instance, telepathy) are enhanced. Synchronizing thus with the planetary resonances, through such techniques as meditation,

drumming, chanting, and trance dancing, has been practiced for thousands, and probably tens of thousands, of years or longer (see Miller and Miller 1983). We can learn to literally tune into the Earth.

Why is it that synchronizing with Schumann resonances may enhance telepathy and other paranormal mental experiences? Could ELF waves be the carrier waves for telepathic information? Telepathy is known to penetrate Faraday cages (metal or wire enclosures that shield against most electromagnetic signals), and ELF waves can penetrate Faraday cages. Speaking of ELF waves in the range of Schumann resonances, Itzhak Bentov suggests, "Such a long wavelength knows no obstacles, and its strength does not attenuate much over large distances. Naturally, it will go through just about anything: metal, concrete, water, and the fields making up our bodies. It is the ideal medium for conveying a telepathic signal. Likewise, ELF can be used as a mode of radio communication; it is especially useful for communication with submarines" (Bentov 1981, 53; see also Bliokh *et al.* 1980, 153–55). Supporting both the reality of telepathy and the notion that some kind of physical wave is involved with direct mental communications, in his study of shamanism the Russian ethnographer Sergei Mikhailovich Shirokogoroff noted:

In the preceding chapters [of his massive monograph, *Psychomental Complex of the Tungus*] I have already given some facts observed among the Tungus and Manchus, which point to the existence of reading of thoughts. I have admitted the possibility of such a reading which is not based upon a system of inferences made from facts, but seemingly in direct communication, probably by a means of physical waves. For the time being the existence of these "waves" is a mere hypothesis, but this may be, at least temporarily, admitted, for the phenomena of "reading of thoughts" in a great number of cases cannot be understood as the result of mere "intuition" or coincidences [of] parallelism of thought in two individuals. This peculiarity is not characteristic of all shamans, some of whom may use it in a lesser degree, others in a greater one; but all of them make this attempt. Communication at a distance is apparently based upon the same physical condition. The shamans attain it by different methods, namely, they may do it in their dreams, during extasy [ecstasy], or in a "normal" state of concentration on a "desire" which they "think strongly". In all these cases the shamans say that they "send the soul" with a communication. It must be pointed out that this can be better done during the night, *i.e.* exactly during the period

good for transmission of waves, undisturbed by sun rays. Another condition must not be forgotten, namely, the shamans attain extasy [ecstasy] much more easily in the dark. (Shirokogoroff 1935, 361)

Shirokogoroff ’s description could well fit the notion of an ELF wave being the carrier wave of telepathic thoughts, even to the point that telepathy works better at night. The fact that the shamans can better reach a state of ecstasy in the dark—that is at night—may also be an indication that they are using ELF waves, probably in the Schumann frequencies, to reach altered states of consciousness. This may be an extremely ancient technique of gaining knowledge.

Thus, ELF waves in the Schumann frequency range may be a way that one human consciousness can connect with another and also tap into the larger collective consciousness and the Earth as a whole. ELF waves and Schumann frequencies are known to be affected by climate cycles and changes, which in turn are strongly affected by, and even regulated by, astronomical factors, including the relative positions of and resonances among the Sun and planets (see review in Mackey 2007). Here again we discover correlations that according to the dogma of conventional established science are totally unexpected or even “impossible.” According to the new science, there are meaningful relationships among fundamental physical phenomena (electromagnetic waves of extremely low frequency), astronomical phenomena (the relative positions of the Sun and planets, and even the stars and galactic center), and brain waves, which in turn affect states of consciousness. Using different terminology, mystics and certain scholars (often in the context of religion, esoteric studies, or occult studies) have accepted and explored such connections since ancient times.

Looking at a broader time frame, and in the context of our variable and unstable Sun, galaxy, and universe, the ionosphere and magnetosphere (as well as the general electromagnetic environment that envelopes us) are subject to changes and fluctuations that could significantly vary the frequency of Schumann resonances. During a major CME or other solar outburst the ionosphere can change in its shape and properties, including increases in the electric currents and charges in the ionosphere and magnetosphere. Waves are distorted as they pass through a turbulent ionosphere (Rengaswamy 2008). Such factors materially affect various radio communications. Could they also affect mental and psychical processes and phenomena? The work demonstrating that spontaneous cases of telepathy and clairvoyance are correlated with geomagnetic

fluctuations (Wilkinson and Gauld 1993) supports this hypothesis.

Major solar outbursts and plasma discharges, well beyond anything seen in the modern era, including the Carrington Event, have happened in the past—including at the end of the last ice age. Plasma discharges are electrical in nature. As discussed in chapter 11, we do not know the full ramifications of subjecting living organisms, including humans, to intense electrical fields, but the effects could be profound, altering organisms genetically, mentally, and psychically.

Very disturbing to me personally is the ongoing High Frequency Active Auroral Research Program (HAARP). HAARP is an ionospheric research program jointely funded and carried out by the U.S. Navy, the U.S. Air Force, the U.S. Department of Defense, and the University of Alaska (see the HAARP website: www.haarp.alaska.edu). HAARP facilities include an array of radio transmitters and antennae that cover an area of over a dozen hectares north of Gakona, Alaska. This is used to send signals and energy into the ionosphere in order to see what will happen; that is, experiments are carried out directly on the ionosphere. This, of course, might raise alarms—and it has. Without getting into conspiracy theories—HAARP has been blamed for disruptions of the jet stream, changes in regional weather patterns (resulting in storms, droughts, floods, hurricanes, and so on), the initiation of earthquakes, major power outages, and the downing of airplanes, to name just a sampling—I seriously wonder what inadvertent (or intentional) effects the HAARP experiments might have, even if the energies used are ostensibly very low relative to natural events, such as the Sun's impact on the ionosphere.

Could ionospheric disruptions caused by HAARP, even if relatively "minor," have subtle but profound effects on life, including human mental states? Very small changes in collective mental states may lead to major material effects, such as whether aggression breaks out in the form of a major conflict, perhaps an all-out war, or which candidate is elected to high office. On another front, I am concerned that the constant modern bombardment of people by electromagnetic radiation, from cell phones to radio communications to power lines to circuits in walls, may have ill and unexpected consequences. There is increasing evidence that organisms, including humans, may be incredibly sensitive to ultraweak electromagnetic fields (see Ho 2011, and references cited therein).

THE POWER OF SOUND

Sound, a type of vibration, can have a very powerful and direct influence on the human mind. Researchers studying ancient megalithic stone structures around the world have discovered that in many cases the monuments may have been specifically designed to manipulate sound and produce specific sensory effects and induce particular mental phenomena. Acoustical studies have been carried out at such sites as the stone temples on the island of Malta (circa 3700 BCE to 2400 BCE), at Newgrange (circa 3200 BCE) in Ireland, at a site known as Wayland's Smithy in England (fourth millennium BCE), and at the ceremonial site of Chavín de Huántar in Peru (circa 1200 BCE to 400 BCE). Stone structures, pillars, and enclosed spaces could be used to magnify, conduct, and enhance certain sounds, producing resonances and standing waves, while filtering out other sounds (*Popular Archaeology* 2012). In particular it has been found that certain enclosed chambers in monumental stone structures show strong resonances at sound frequencies of between about 95 Hz and 120 or 130 Hz (Eneix 2012). For instance, Linda Eneix, an expert on the ancient Malta temples, states that structures there resonate in the range of around 110 or 111 Hz (Eneix 2012).

According to Eneix,

Regional brain activity in a number of healthy volunteers was monitored by EEG [electroencephalogram] through exposure to different sound vibration frequencies . . . The findings indicated that at 110 Hz the patterns of activity over the prefrontal cortex abruptly shifted, resulting in a relative deactivation of the language center and a temporary shifting from left to right-sided dominance related to emotional processing and creativity. This shifting did not occur at 90 Hz or 130 Hz. . . . In addition to stimulating their more creative sides, it appears that an atmosphere of resonant sound in the frequency of 110 or 111 Hz would have been "switching on" an area of the brain that bio-behavioral scientists believe relates to mood, empathy and social behavior. Deliberately or not, the people who spent time in such an environment under conditions that may have included a low male voice—in ritual chanting or even simple communication—were exposing themselves to vibrations that may have actually impacted their thinking. (Eneix quoted in *Popular Archaeology* 2012)

If this is true (and I have no reason to doubt it), these ancient peoples were

manipulating sound for some very subtle and sophisticated reasons. And they may have been doing so much earlier than the temples of Malta. Commenting on the site of Göbekli Tepe, which dates back nearly twelve thousand years (see discussion in chapter 3), Eneix has stated, “In the center of a circular shrine . . . a limestone pillar ‘sings’ when smacked with the flat of the hand. Obviously made to represent a human with a decorated belt and hands carved in relief at its waist, it bears unexplained symbols in the area of the throat” (Eneix quoted in *Popular Archaeology* 2012).

Eneix goes on to wonder, “How curious that such varied ancient structures, separated by so much time and distance, should have common features which imply sophisticated knowledge. . . . Did the architects of the day each make and develop their own discoveries or did they inherit a concept from some older school of learning? Adding the time element to other fields of comparison suggests human trail-blazing of monumental proportion” (Eneix quoted in *Popular Archaeology* 2012). I believe that the case can be made that the ancients as we know them did indeed inherit much of their knowledge from even more ancient peoples, from “some older school of learning.” This may be one more example of lost knowledge that is only now being rediscovered.

THE POWER OF WATER

Liquid water is essential to life as we know it. Without liquid water we could not exist. The chemical formula for water is H2O, two hydrogen atoms joined to an oxygen atom: this simple molecular formula for water belies its incredible, and often subtle, complexity, a complexity that science is only beginning to discover. There is now strong evidence that liquid water, particularly in living systems, clusters into frameworks with the ability to store and transmit information and mediate chemical and biological functions. As Bennett Daviss wrote in a 2004 review article, “Evidence is mounting that water in living systems naturally gathers into frameworks of 14, 17, 21, 196, 280, or more molecules. Some say that the clusters’ apparent existence necessitates redesigning simulation models of life processes. And support is growing behind the idea that these intricate structures play key roles in operations ranging from molecular binding to turning on and off basic cell processes” (Daviss 2004).

Since these words were written, it has become apparent that the subtlety and power of water (particularly the power to encode, preserve, and transmit information) is even greater than suspected.

The concept of water memory (that liquid water can encode, store, and transmit information), which is essentially the basis of homeopathy, has a long and tumultuous history. More often than not the mainstream scientific community has flatly rejected the notion of water memory—this despite the growing, if still controversial, evidence that water can carry information (see reviews by Chaplin 2007; Dunning-Davies 2011a, 2011b; Hutchinson 2008; Milgrom 2003; Pringle 2003; and Singh 2008). Recent discoveries discussed in the first paragraph of this section concerning the incredible complexity of liquid water under some circumstances provides a theoretical way that indeed water could store and transmit information.

New, and needless to say extremely controversial, experiments carried out by a group led by Luc Montagnier are shedding new light on the relationship between organisms, DNA, and water. (Montagnier was cowinner of the 2008 Nobel Prize in Medicine for his work on identifying HIV [human immunodeficiency virus] and its relationship to AIDS [acquired immunodeficiency syndrome]; however, see Papadopulos-Eleopulos *et al.* 2004, for an argument that HIV does not cause AIDS.) Central to Montagnier's work is his discovery (disputed by many mainstream scientists) that sequences of DNA (deoxyribonucleic acid, the basic genetic material of most life on Earth; some viruses use the related RNA [ribonucleic acid] as genetic material) dissolved in water at very high dilutions can emit weak electromagnetic signals or fields, specifically in the ELF range. Montagnier and his group then went on to demonstrate that, in their own words, "These [electromagnetic] fields can be induced by suitable procedures in water dilutions which become able to propagate the information contained in the DNA of the original organisms to other ones" (Montagnier *et al.* 2010, 1; see also review, Ho 2011).

The experiments of Montagnier *et al.* were cogently summarized in *New Scientist* as follows:

Two adjacent but physically separate test tubes were placed within a copper coil

and subjected to a very weak extremely low frequency electromagnetic field of 7 hertz. The apparatus was isolated from Earth's natural magnetic field to stop it interfering with the experiment. One tube contained a fragment of DNA around 100 bases long; the second tube contained pure water.

After 16 to 18 hours, both samples were independently subjected to the polymerase chain reaction (PCR), a method routinely used to amplify traces of DNA by using enzymes to make many copies of the original material. The gene fragment was apparently recovered from both tubes, even though one should have contained just water. . . .

DNA was only recovered if the original solution of DNA—whose concentration has not been revealed—had been subjected to several dilution cycles before being placed in the magnetic field. In each cycle it was diluted 10-fold, and "ghost" DNA was only recovered after between seven and 12 dilutions of the original. (Coghlan 2011)

In effect, if the experiment is correct (and I personally have no reason to doubt it), the DNA in the original solution appears to have transmitted information concerning its structure to the adjacent pure water, and then when the proper ingredients were added to the pure water a copy of the DNA could be produced! The information itself, Montagnier *et al.* suggest, is transmitted via ELF waves emitted by the DNA that in turn imprint the structure of the DNA on the water in the form of water nanostructures that can then be used by enzymes to create a copy of the DNA from raw ingredients (specifically nucleotides in this case). This the editors of *New Scientist* referred to as "teleported DNA" (Coghlan 2011, and accompanying editorial).

Reaction to this work has been strong. An editorial in *New Scientist* opined, "It's good to have an open mind but not so open that your brains fall out. This week we report claims about the way that DNA behaves that are so astonishing that many minds have already snapped shut" (editorial accompanying Coghlan 2011).

Jeff Reimers, a theoretical chemist at the University of Sydney, Australia, was quoted as saying, "If the results are correct, these would be the most significant experiments performed in the past 90 years, demanding reevaluation of the whole conceptual framework of modern chemistry" (Reimers, quoted in Coghlan 2011).

Perhaps modern chemistry (as well as modern physics, modern biology, modern astronomy, modern climatology, modern anthropology, and modern archaeology) needs to be reevaluated!

Montagnier *et al.* discuss the implications of a "theory of liquid water based on Quantum Field Theory" wherein the "binding [of liquid water molecules into larger structures] is actually induced by the time-dependent radiative long range em [electromagnetic] field. Short range static bonds, such as H-bonds [hydrogen bonds between water molecules], then set in as a consequence of the molecule condensation induced by such long range radiative fields" (Montagnier *et al.* 2010, 5).

In other words, background electromagnetic fields play a crucial role in determining the structures, properties, and capabilities of water (H_2O) and thus the ability of water to store and transmit information, as demonstrated by the experiments of Montagnier *et al.*

Reading first the *New Scientist* article about their work and then reading the original paper by Montagnier et al., I noticed that the 7 Hz electromagnetic frequency they used to "excite" the DNA is very close to the basic Schumann resonance of 7.8 Hz. Reading further the original Montagnier *et al.* paper, I saw that this had not escaped the notice of the authors! As Montagnier *et al.* explain, how certain ions in a cell respond to background electromagnetic fields of various frequencies is extremely important. Based on their analysis, these researchers conclude that life on Earth at a cellular level is finely tuned and adapted to the natural Schumann resonances, with the most basic resonance occurring at approximately 7.8 Hz. They note that their work may "provide a rationale for the observed impact of ELF fields on the physiological activity" (Montagnier *et al.* 2010, 8).

Montagnier *et al.* end their paper with the following perceptive remarks: "Our work is interdisciplinary, involving biologists, physicists, and medical doctors. There are of course many unresolved questions raised by our findings, which deserve more work and more interactions. DNA signalling is stimulated by 7 Hz naturally occurring waves on earth [the basic Schumann resonance]. Waves produced by the human brain are also in the range of 7 Hz. These are interesting questions to be asked and possibly answered" (Montagnier *et al.* 2010, 10).

Might this be a reason that calm meditation, generating brain waves in the Schumann frequencies, is so healthful and particularly useful in physiological healing?

Many people, including scientists and physicians, simply dismiss weak and/or ELF electromagnetic fields as being trivial and not capable of having any impact on living organisms (including humans). Such an attitude may be a huge mistake. Background electromagnetic fields, even if incredibly weak, may be all-important to the proper physiological and mental functioning of humans and all of life on Earth. Tampering with such background electromagnetic fields may have inadvertent and unexpected consequences. Yet, modern technology does just this; we are bathed and surrounded by "unnatural" electromagnetic fields. And when we look at the course of geological history over millennia to billions of years, we have to ask ourselves, How have electromagnetic fields on the surface of Earth changed, and what were the consequences? During major solar outbursts and plasma phenomena, such as at the end of the last ice age, what effect did changing electromagnetic fields have on the people of the time and on life more generally? Perhaps going underground and in caves would have served as protection from higher-frequency waves while allowing the benefits of Schumann low-frequency waves (which can penetrate much deeper and through much thicker rock) to be maintained, that is, assuming that Schumann resonances were not totally disrupted.

ENTANGLED DIAMONDS

In the mysterious world of quantum mechanics the concept of entanglement occurs when particles interact and are then separated, but they are still somehow correlated (or more accurately, anticorrelated) in terms of their characteristics. Acting on one particle will result in an effect or outcome on the other particle, even if a considerable distance physically separates the particles and there is no direct conventional physical or energetic link between them. To use a crude analogy, if two coins in the process of being tossed are entangled in a quantum mechanical sense, when one coin comes up heads the other coin will come up tails (remember, they are anticorrelated). Albert Einstein referred to quantum

entanglement as *"spukhafte Fernwirkung"* (spooky action at a distance), but it has been demonstrated experimentally numerous times, and the effects of entanglement seem to propagate either instantaneously or at a speed thousands of times faster than the speed of light (which is highly perplexing). Up until now quantum entanglement has generally been considered limited to very small microscopic objects, such as subatomic particles, atoms, isolated molecules, and microscopic crystalline structures. In December 2011 a group of physicists from the University of Oxford, the National Research Council of Canada, and the National University of Singapore announced the successful quantum entanglement, using lasers, of oscillation patterns of atoms in two macroscopic (approximately 3 millimeters in size) diamonds at room temperature and separated by a distance of about 15 centimeters (Lee *et al.* 2011; Duan 2011).

Leaving the details of the experiments aside, the quantum entanglement of the diamonds is not particularly controversial for the experimental results are clear and definitive. The entanglement of macroscopic diamonds at ordinary room temperature under ordinary conditions demonstrates, I believe, that it is wrong to assume that quantum entanglement (and other "mysterious" quantum effects as well) is limited to the microscopic world and can have no real consequences in our everyday lives. There has long been talk in some circles (though previously unconvincing) that certain psychic or paranormal phenomena such as telepathy could be due to quantum entanglement. Now the entangled diamonds appear to provide strong evidence that such entanglement and correlation of information is indeed possible. In my experience telepathy tends to work best when one is in a mental state decoupled from the immediate surrounding environment, which allows the mind of the individual to couple or entangle with the mind of another individual (or individuals).

Like minds in telepathic rapport, diamonds best maintain their quantum entanglement when they can be decoupled from "distractions" or the entanglement is stronger than the distractions (in the case of the diamonds, distractions might include such phenomena as being excited by environmental changes, like temperature or physical movement). Of course, most hardcore physicists tend to dismiss telepathy as nonsense even as they will accept the quantum entanglement of diamonds. It also needs to be pointed out that phenomena generally regarded as telepathic may include a mixture of phenomena due to different causal mechanisms; thus some forms of telepathy

may be the result of quantum entanglement, and other forms of telepathy may be due to electromagnetic radiation, particularly in the extremely long wavelength and ELF range, as discussed in the “ELFs: Tuning into the Earth” section earlier in this chapter.

THE FINE STRUCTURE OF THE UNIVERSE

In modern physics the fine-structure constant, denoted by α (alpha), is generally considered a fundamental constant of the universe. It basically characterizes the strength of the electromagnetic force or interaction, it is dimensionless (that is, unitless), and its currently accepted value is approximately .007297 = 1/137.036. In turn, α can be expressed in terms of other physical constants such as Planck’s constant, the elementary charge, the electric constant, the magnetic constant, the Coulomb constant, and the speed of light in a vacuum; thus, α can be viewed as summarizing a number of fundamental properties of the universe as we know it. Indeed, matter in a stable state, and therefore life as we know it, could not exist if the fine-structure constant differed very far, even by a small percentage, from its current value; carbon atoms, for instance, upon which life as we know it is based, would not form naturally. The great physicist Max Born (1882–1970; Nobel Prize in Physics, 1954) is quoted as saying, “If α [the fine structure constant] were bigger than it really is, we should not be able to distinguish matter from ether [the vacuum, nothingness], and our task to disentangle the natural laws would be hopelessly difficult. The fact however that alpha has just its value 1/137 is certainly no chance but itself a law of nature. It is clear that the explanation of this number must be the central problem of natural philosophy” (Born, quoted in Miller 2009, 253; bracketed material in the orginal).

But the fine-structure constant, and consequently other related physical “constants,” might not be so constant after all. An accumulating body of evidence suggests that there are changes in the fine-structure constant over space and time (see Webb *et al.* 2010; Berengut and Flambaum 2010; for differing views, see Carroll 2010, and Orzel 2010). As the staff of the popular *Space Daily* (2010) wrote, this “finding could mean rethinking the fundaments of our current knowledge of physics.” As we have summarized above, this is not the only evidence that suggests our current models in science need to be rethought.

The fine-tuning of the fine-structure constant (α) and other physical

constants, such that they are “just right” for life, and humans in particular, to exist is sometimes referred to as the anthropic principle. Why α is just right has long perplexed some of the greatest of modern thinkers. (Admittedly other people have simply dismissed it as a nonissue, arguing that we just happened to have evolved to fit our environmental conditions; the environment and physical constants were not designed to fit us.) The nonconstancy of the fine-structure constant may help solve this conundrum. As Julian C. Berengut and Victor V. Flambaum write:

Discovery of a spatial variation in the fundamental constants of nature has massive implications for the “fine-tuning” problem. This is the question of why the constants of nature seem to be finely-tuned for life to exist. While the anthropic principle can be invoked to explain such tuning of the Universe, there remains the question of how it could come about. With the detection of spatial variation of constants we begin to have a natural explanation for fine-tuning: with many possibilities for combinations of constants all occurring within the (possibly infinite in extent) Universe, we simply appear in the part of the Universe that is consistent with our existence. (Berengut and Flambaum 2010, 1)

A MATTER OF TIME

In April 2012 a research team from the U.S. National Institute of Standards and Technology reported on an experiment involving the generation of light pulses traveling faster than the speed of light in a vacuum (Glasser *et al.* 2012). A wave peak on a pulse of light was forced to move from back to front along the light beam as the light itself was traveling at the standard speed of light, such that the pulse traveled faster than the speed of light in a vacuum. If refined, such a technique could possibly allow information to be sent faster than the speed of light. This work follows on the heels of a major brouhaha over another alleged instance of faster than light speeds—reports that neutrinos (electrically neutral and weakly interacting subatomic particles) had been measured traveling faster than the speed of light while passing through 732 kilometers of rock from the CERN particle physics laboratory in Geneva, Switzerland, to a particle detector in the Laboratori Nazionali del Gran Sasso in Italy (Adam *et al.* 2011). This raised a huge stir, as standard modern mainstream physics theories, many based

in large part on Einstein's special theory of relativity (first proposed in 1905), have long assumed that the speed of light in a vacuum is the upper limit of how fast anything can travel; therefore, if such results were correct, some of the most basic assumptions in modern physics would need to be reevaluated. Ultimately, based on carrying out further experiments, including at other labs, it was announced, "the original . . . measurement can be attributed to a faulty element of the experiment's fibre optic timing system" (Bertolucci 2012).

A major objection to the possibility of superluminal (faster than the speed of light) travel is that it will upset cherished notions of time and temporal ordering (conventional thinking asserts that the past must occur before the present, which must occur before the future). From our perspective, particles traveling faster than light might be viewed as traveling backward in time (arriving one place before they depart from another place) or through other dimensions, and this would open the possibility of effects occurring before causes (although exactly what "before" means in this new notion of time is open to debate; see Moskowitz 2011; Palmer 2011a; Wolchover 2011). That is, the concept of retrocausality (the future influencing the present and the past), which many people (including many theoretical physicists) instinctively reject, would have to be taken seriously. Yet there is evidence of retrocausality. A group centered in Vienna, Austria, headed by Anton Zeilinger (Ma *et al.* 2012), has experimentally demonstrated that the decision as to whether or not two particles at a quantum level are entangled or in separate quantum states can be made after the particles have been measured (and may no longer exist). Furthermore, there is solid parapsychological support for retroactive influences on the human mind.

THE INFLUENCE OF THE FUTURE ON THE PAST

We live in a cause-and-effect world. Causes come before their effects, not vice versa. Time is unidirectional, moving from the past to the present to the future. We might regret or cherish the past, but we cannot go back in time. I teach. My students study and then take the exam. It would not make sense for them to first take the exam and do their studying afterward. Well, they might learn the material after the fact, but that is hardly going to help them on the exam that they already took!

In the last paragraph I have described the commonsense world that most

people know and believe in. Few seriously question it, yet it just might be wrong. Take the example of studying for an exam after taking the exam. Daryl J. Bem of Cornell University reported on a series of "retroactive facilitation of recall" experiments (Bem 2011). Students were shown forty-eight words (nouns, such as names of animals or foods) and then asked to recall as many of the words as they could remember. After the recall test, the students were subjected to practice with half of the words (picked randomly by a computer). That is, the students "studied" half of the words after taking the test. By commonsense thinking this after-the-fact studying should have no bearing on how the students did on the test. However, such was not the case. The students did significantly better on the recall of the words that they practiced, even though the practice followed taking the test. To quote from Bem's paper directly, "The results show that practicing a set of words after the recall test does, in fact, reach back in time to facilitate the recall of those words" (Bem 2011, 41 [typescript version]).

These are astounding results, but they corroborate a huge array of data that the skeptics and debunkers have consistently refused to acknowledge, data that support the idea that the future can influence the present and the past (Schoch and Yonavjak 2008).

Another one of Bem's experiments involved the precognitive detection of erotic stimuli. Subjects were able to determine, at a level significantly more frequent than random, behind which "curtain" on a computer screen an erotic image would appear, even though the position of the erotic image was not determined until after the subject made her or his choice. That is, the subjects seemed to be able to access information from the future. An argument against the precognition hypothesis is that perhaps the subjects could psychokinetically cause the computer to position the image behind the screen of choice. This hypothesis was considered by Bem, but was rejected as less likely than genuine precognition since he obtained significant results with these experiments using both true random number generators as well as pseudorandom number generators (which use a mathematical algorithm to generate a series of "random" numbers—a series that presumably is immune to change via psychokinesis) as ways to determine randomly the image placements. Furthermore, these Bem precognition studies in the laboratory form part of a continuum with numerous other examples of precognition, including the detailed precognition of specific future events by individuals, such as the dozens of people who "precognized"

the 1966 Aberfan disaster (a huge pile of coal slag and debris came crashing down on Aberfan, Wales, killing 144; see discussion in Roy 1990).

THE SCIENCE OF THE FUTURE

Is there any scientific theory that can cogently account for the future influencing the past?

In physics the transactional interpretation of quantum mechanics, developed by John G. Cramer, of the University of Washington, Seattle, explicitly introduces the concept of the future influencing the present or past (the present is the past relative to the future) at the quantum (submicroscopic) level. Building on the work of such luminaries as famed physicist John Wheeler (1911–2008) and Nobel Prize–winning physicist Richard Feynman (1918–1988), the transactional interpretation uses both "retarded waves" (temporally "normal" waves propagating forward in time) and "advanced waves" (waves that propagate backward in time) sent out by an "emitter" and receivable by an "absorber" (the same entity may variously be an emitter or an absorber). A quantum event consists of an exchange of such waves. As Cramer describes it, an "offer" wave is sent out in one time direction and a "confirmation" wave is sent back in the other time direction, thus completing the quantum event (Cramer 1986). According to Cramer, the collapse of the wave function, when quantum probabilities are manifested as realities, is accomplished through the exchange of the offer wave and confirmation wave; when summed together, the overall process is essentially nontemporal.

Elaborating on the transactional interpretation, Cramer writes:

In the quantum world, the plane of the present must be a fuzzy region with the past on one side in time and the future on the other, but with some uncertainty in the central region about which is the past and which is the future. Across this region there must occur the freezing of possibility into reality, but possibility and actuality are mixed and smeared by time indeterminacy. . . . The transactional interpretation asserts that at the quantum level time is a two-way street, in which at some level the future determines the past as well as the past determining the

future. (Cramer 2001, 3, 5)

If this is the case in the quantum world (I find the evidence convincing), then I believe it is not only conceivable but also highly likely that this two-way street is applicable not solely to the quantum level, but in some cases manifests at the macroscopic level. Indeed, the overwhelming evidence for precognition and retrocausality supports this conclusion (Schoch and Yonavjak 2008).

Let us return to Bem's recall research. A potentially significant point concerning Bem's "retroactive facilitation of recall" experiments is that those tested did not know the results of their tests (at least this appears to be the case based on Bem's description of the experiments) prior to the practice for the test. That is, each subject took the test and then immediately practiced without being aware of the results of the test just taken. This seems to tie in with the concept that the future can influence or affect the past, but it cannot change the past. Once a quantum transaction or a series of quantum transactions that we can observe macroscopically takes place (is completed), the event or events are fixed (although in some cases we may view an event as fixed that at a quantum level is not yet fully completed and thus is mutable). As the physicist Olivier Costa de Beauregard (1911–2007) put it, ". . . telegraphing backward in time does not mean 'reshaping' history, but shap ing it from the future" (Costa de Beauregard 1987, 284).

In the case of the experiments by Bem, if the subject already knew what she or he had scored on the recall test, I hypothesize that the result would not be changed by further after-the-fact practice. So long as the result of the test remained indeterminate (at least from the perspective of the subject), future practice by the subject could exert an influence on the past (the result of the recall test), but this possibility (the influence of the future practice on the result of the past test) would end once the subject learned the result of the test. It does not matter if other people know the outcome of the test (or if the outcome has been recorded mechanically or electronically), as long as the subject does not know the outcome. In a similar context, using the example of paranormally influencing a lottery drawing via psychokinesis, Garret Moddel, of the College of Engineering and Applied Science, University of Colorado, has written, "It is not necessary to consider the knowledge that others have of yesterday's outcome if you have not been informed of their knowledge. The outcome that others knew of will simply be the one that exists in response to your intention" (Moddel

2006, 68).

We might regard such a situation as one where the past event exists; however, it was not brought about simply by past events but by future events as well.

But if future events exist, at least to the extent that they can influence the present and past, where does that leave us? Is the future already fully determined, in which case some might argue that free will is an illusion? Or is the future itself more like an influence, a tendency, neither totally absent nor fully existent, something that pulls on us, draws us toward it, but does not force us irrevocably into any particular fate or destiny? These are issues that I ponder as I continue to explore the nature of time.

ZEP TEPI

The point of this chapter is that new science—hardcore, no-nonsense, cutting-edge science—is demonstrating that fundamental physical, chemical, and biological processes, astronomical phenomena, life, Earth, consciousness, and the cosmos are all interrelated. This is not a metaphorical or literary allusion: the connections are real and inescapable. Recognizing these relationships entails a major revision of how we view the world and our place in it. Furthermore, these connections are not posited just in the present, but they also extend both back in time and into the future. That is, we are strongly influenced by the past and—given the strong evidence supporting the reality of precognition (Richet 1931; Saltmarsh 1938) and retrocausation (Bem 2011)—possibly even by the future to some extent. I believe that future science will be based on the ancient wisdom.

As I bring this book to a close, I cannot help but ponder the ancient Egyptian concept of Zep Tepi (Crystal 2011; also referred to as Tep Zepi, see Heinberg 1989, 44). In ancient Egyptian, Zep Tepi means the “first time,” the time of the creation, the beginning of civilization, a golden age when the “gods” lived among humans. The concept of Zep Tepi refers to the first civilization, but it also has a deeper cosmological meaning and implications as well: the creation of

time itself.

Egyptologist Rundle Clark succinctly captured the essence of Zep Tepi, writing:

This epoch—*zep tepi*—"the First Time"—stretched from the first stirring of the High God in the Primeval Waters. . . . All proper myths relate events or manifestations of this epoch. Anything whose existence or authority had to be justified or explained must be referred to the "First Time." This was true for natural phenomena, rituals, royal insignia, the plans of temples, magical or medical formulae, the hieroglyphic system of writing, the calendar—the whole paraphernalia of the civilization . . . all that was good or efficacious was established on the principles laid down in the "First Time"—which was, therefore, a golden age of absolute perfection. . . . (Clark 1978, 263; quoted by Bauval and Brophy 2011, 241; italics in the original)

Robert Bauval and Thomas Brophy (2011), in their book on the origins of ancient Egyptian civilization, date Zep Tepi to an era around 12,000 BCE based on the astronomy of the ancient Egyptians, especially as recorded at Giza (site of not only the Great Sphinx but also the Great Pyramid). Although their full analysis is much more extensive and involves a number of other lines of evidence, they summarize a central aspect of their reasoning as follows: "The southern shaft of the Queen's Chamber [of the Great Pyramid] invites us to consider two altitudes of the star Sirius, one at 39.5 degrees and the other at 0 degrees, thus determining two dates: 2500 BCE, which is probably the actual construction date of the pyramid, and 12,000 BCE, which represents a date in the remote past that has to do with the beginning or first time of the ancient Egyptians' history defined with calendrical computations of the Sothic cycle and precession cycle of the star Sirius" (Bauval and Brophy 2011, 246–47).

This date of circa 12,000 BCE falls near the end of the last ice age, and very roughly (within a couple of millennia) can be viewed as about the time of Göbekli Tepe and, quite possibly, the origins of the Great Sphinx. Does Zep Tepi refer to the first flowering of civilization, just prior to the end of the last ice age? As I have pointed out in previous chapters, the name Göbekli Tepe and a traditional name for Easter Island, Te Pito Te Henua, both refer to the navel, perhaps indicative of birth, origins, and beginnings, as in the beginning of civilization at the end of the last ice age. Was this the original golden age, the

first time of civilization? Was it brought to an end by solar outbursts? Thousands of years later, was it an epoch primarily remembered in myth, and later were the myths relegated to the status of fairy stories, of no historical value, and ultimately dismissed by modern science?

Yet, at many levels this may be an injustice; even as history may be transformed into myth, it may retain value of a different nature, perhaps of a more fundamental nature, such as the true relationship of humanity to the cosmos—as is beginning to be rediscovered. I find truth in the following words of the great Romanian philosopher and historian of religion Mircea Eliade (1907–1986): "'Myth' and 'history' represent two different modes of existing in the World, two different approaches of the mind to the interpretation of the data of reality—modes of being and activities of the mind that, in any case, are not mutually exclusive. A people, as well as an individual, can be conscious of its responsibilities in history and courageously assume them, while at the same time continuing to enjoy the ancient myths and legends and to create new ones; for they account for other dimensions of human existence" (Eliade 1972, 131–32).

OUR PAST AND OUR FUTURE: A FEW FINAL REMARKS

Sometimes it can be difficult to bring a book to a close. There is so much more one could write, always another fact or reference one might add. I hesitate as I send this typescript to the publisher. Why? Because I fully realize that much of the material discussed in this book is highly controversial and will not be readily accepted by mainstream conventional thinkers. I ponder what the critics may say. Some will dismiss the scientific evidence I present out of hand, not giving it a sincere and objective look. Others will label me an alarmist, someone who is predicting that a major solar outburst (or other natural catastrophe) will soon bring about the "end of the world," or at a minimum the end of modern civilization and technological societies as we know them. To defend myself, I would assert that I am only pointing out what could happen given our current understanding of Earth, our solar system, and the universe at large. Whether or not such events will happen, when they may, and the specifics of such a catastrophe are not in my realm to predict. Yet I brace myself for the potential name-calling ("Schoch is an alarmist," "Schoch is a pseudoscientist," "Schoch just likes the publicity") for I have heard it all before (I have even been referred to as a heretic).

The controversy over the age of the Great Sphinx has hardened me against personal attacks. In truth, the staunchest critics—the defenders of the status quo—will probably never change their views, never give up their most cherished paradigms, and this is one of the primary messages that I would like to impart to my readers. If you have read this book carefully, I hope you realize that I am simply a person who looks at all of the evidence, following it to logical conclusions, even if those conclusions are not in agreement with mainstream views. But still, I wonder, have I said enough? Ultimately, however, if a book is to be published, eventually the author must let go. Yet, the story continues to develop. So let us, in closing, briefly summarize the main threads of the narrative.

As I have described in this book, geological data indicate that the last ice age ended extremely suddenly, catastrophically, around 9700 BCE. This is the time of Göbekli Tepe, possibly the date of the earliest incarnation of the Great Sphinx, and, I believe, the date of a major solar outburst that is recorded in petroglyphs and the rongorongo texts of Easter Island, further supported by studies of ice cores, sediment cores, and lunar data. Yes, there are many petroglyphs around the globe, and some have nothing to do with solar outbursts, but other petroglyphs (those studied intensely by Anthony Peratt and discussed in this book) do represent solar/plasma configurations and major auroral displays (and of these, some may represent major auroral displays since the end of the last ice age). Likewise, even if some of the surviving rongorongo glyphs and texts may ultimately prove to have been used for alphabetic and linguistic purposes, this will not negate the idea that the rongorongo glyphs were first inspired by plasma configurations in the skies and that the earliest rongorongo texts document a major solar outburst.

Our unstable Sun, erupting at the end of the last ice age, melted glaciers that covered much of the land, evaporated tremendous amounts of water, and warmed the climate. In places the surface of the planet was incinerated as a huge plasma ball hit, and tremendous electrical storms filled the atmosphere, touching down to set conflagrations. To escape the terror, the few survivors may have been forced to seek shelter underground and in caves. Only megalithic rock structures could withstand the onslaught. No doubt this is why there is such a scarcity of physical remains from this early period.

Bathed in steam, the atmosphere could only hold so much water before it would precipitate out as tremendous and protracted rains. This, combined with the melting of the glaciers, would have created huge floods. Deluges are a part of myth and legend among virtually every ancient culture around the world; the Judeo-Christian biblical Noachian flood is but one example. Recollections of cataclysmic events destroying an advanced civilization that flourished thousands of years before the civilizations of ancient Egypt, Sumeria, or Greece are also nearly universal. Tying in with my work on the Great Sphinx, a key consideration in my analysis is that the Sphinx was clearly weathered and eroded by water, by precipitation, not simply by wind and sand. Yet the Sphinx sits on the edge of what is now the Sahara Desert. Could deep fissures and other water-induced erosional features on the body of the lion—on the body of the Great Sphinx—be the scars of this cataclysmic epoch? I believe so.

Since those catastrophic times, for the past ten thousand years, our Sun has been relatively quiescent, but it is now entering an active period once again, the likes of which have not been seen since the end of the last ice age. This we need to understand in order to assess the future realistically. To point out the facts as described in this book is, in my opinion, simply prudent. Civilization was dealt a mighty setback around 9700 BCE, one that lasted thousands of years. We are just beginning to remember, to reconstruct, what happened in those ancient times. Should events of the past recur—indeed, the study of geology teaches they do—we would do well to collectively prepare.

I believe we are at the beginning of a new cycle; major changes are on the horizon. The ramifications and reverberations of the coming changes could be much more extensive than most people want to imagine. It is imperative to acknowledge that our planet and all of life on it, including humanity, are much more intimately connected to, and affected by, the cosmos than most people realize. We do not live in isolation. Consequently, the coming changes could hit hard, impacting our way of life and threatening our very existence. However, this need not be the case. As I have outlined in this chapter, many new discoveries (or some would say, many rediscoveries of ancient wisdom) are being made in diverse scientific disciplines at an accelerating pace. I see many cracks developing in conventional, mainstream, status quo thinking, and as these cracks widen to form chasms, a new paradigm is emerging. This is a paradigm of interconnectedness, a paradigm of cooperation, a paradigm that transcends mere

materialism, a paradigm of complexity where consciousness and spirit play a vital role.

Now is the time for a realistic assessment, stripped of ideological blinders, of our past, our potential future, and our place in the grand scheme of things. It is my hope that this book will help contribute to the new paradigm, the new understanding, of our world. With knowledge and insight, I believe we can face the coming changes. Working together, we can address whatever the future may hold.

From Stars We Come and Thence We Return

Mythologist Ev Cochrane has written, “Although an aura of mystery surrounds the religious beliefs of the ancient Egyptians this much is certain: they were obsessed with the stars. The leading gods were identified with prominent stars; their most impressive and enduring monuments—the pyramids—were decorated with stars and patterned after a celestial prototype; and their single-minded goal, upon dying, was to return to a celestial Hereafter where they hoped to be reunited with the sun god and the Imperishable Stars [the circumpolar stars]” (Cochrane 2009, 1).

This idea of coming from the stars and returning to the Sun and stars inspired my wife, Katie, to develop a theory that she calls the G! theory (“G” stands for gravity, God, the grand architect of the universe). In a nutshell, her initial proposal was that stars are made of hydrogen, a major element in our physical makeup as well (our bodies contain a large component of water [H2O], and hydrogen is an important component of organic carbon-based molecules that make up all organisms). And, a large percentage of the matter within us can be traced back to stars—stardust. What if, Katie suggests, when we die, our hydrogen is released, and being light, it floats up to the heavens (to space) were it collects as clouds, collapses under gravitational attraction, is compressed, and we are literally reborn as stars? What if this is a grand (or the grandest) cycle of life?

Information and Consciousness

There is increasing scientific evidence that liquid water can form nanostructures with the ability to encode, store, and transmit information (see discussion in the

section titled “The Power of Water” earlier in this chapter. The case can be made that information is the most fundamental aspect of the universe, and one can cogently argue that information is ultimately equivalent to thought or consciousness (see further discussion in appendix 4). Max Planck, the founder of quantum theory and winner of the 1918 Nobel Prize in Physics, stated in a 1931 interview, “I regard consciousness as fundamental. I regard matter as derivative from consciousness. We cannot get behind consciousness. Everything that we talk about, everything that we regard as existing, postulates consciousness” (Planck, quoted in Fussell 1933, 199).

This is a very interesting, and powerful, statement.

If, as I believe, consciousness presupposes information, then there must be a way to record and manipulate information if consciousness is to exist (such consciousness we self-evidently seem to have, if in fact I am consciously writing this book and you are consciously reading this book). But what are the mechanisms to record information? In the everyday macroscopic world writing, symbols, artwork, digital encoding using numbers, analog recording using waves, and so forth immediately come to mind. In the biological world genetic information is encoded in the structure of DNA, with the nucleotides often compared to the letters of an alphabet. But how is the “information of consciousness” recorded? Is the human brain, or any biological brain, truly comparable to an electronic computer storing bits of information in a material medium? Can consciousness exist independent of gross material structures such as a brain or some other “machine”—be it a natural biological machine (perhaps as simple as a single cell, or simpler) or be it a human-made artificial machine? (Arguably some forms of computers and other “artificial intelligence” are on the verge of reaching true consciousness, or perhaps they already have done so, although we do not realize it.) Entities like crystals and rocks can also record information. Does this mean they possess consciousness at some level? What about plants and single-celled organisms? The work of Cleve Backster (2003) indicates that they do possess consciousness and that this consciousness can be detected using electronic equipment such as a polygraph (lie detector) connected to a plant or by electronically monitoring the behavior of cells. As unbelievable as it may sound to some, Backster’s experiments demonstrate that plants, and even cultures of cells, can respond to thoughts, emotions, and intentions.

The “consciousness and information problem” is a real issue. The power of water to store and transmit information (see discussion in chapter 14) may provide a clue to the more general concept of consciousness in the universe. Water, on the face of it, is a very simple structure chemically; each molecule is composed of two hydrogen atoms and one oxygen atom. If such a simple structure can encode, store, and transmit information—a basic requirement of consciousness—could one of its simple components, namely hydrogen atoms, do the same? Might hydrogen atoms be able to store information and thus form the basis for consciousness?

Hydrogen is the simplest known element (although still composed of smaller subatomic particles). Hydrogen atoms are the most abundant atoms in the universe. (However, we still do not know what form most of the mass of the universe takes; it appears to be in the form of something other than elements, perhaps the mysterious “dark matter”.) Hydrogen, furthermore, is the most common element of our Sun and most stars, and hydrogen pervades our solar system. So could “simple hydrogen” be a carrier of information, and thus the seat of consciousness at some level? Could we, as biological organisms, essentially encode messages and information in the hydrogen of our bodies while we are alive, and then upon death, when our bodies decay and disintegrate away, release hydrogen and its encoded information to be recycled again? After bodily death does our hydrogen gather, regroup, and form new entities, new suns, that carry on our information and consciousness at a different level or in a different form? Katie sums it up this way: somewhere in the heart of the Sun, entropy changes to information and a new cycle begins (see appendix 4, for a discussion of entropy).

For my part, I am not sure what to think. Perhaps Katie is on to something with her G! theory. If water, and possibly simple hydrogen, can store and transmit information, perhaps there is an even simpler level of matter that can store information—simpler than an atom of hydrogen or a single proton. (The simplest form of a neutral hydrogen atom consists of a proton and an electron; there are also ions [charged forms] and isotopes [containing neutrons] of hydrogen.) Perhaps some subatomic particle, a hypothetical “informaton” (a fundamental information particle), has the ability to code and transmit information and withstand disintegration and decay, allowing information and consciousness to persist.

From Star to Star

Consciousness remains a mystery at many levels, and as Planck expressed, consciousness appears to be fundamental to all else. This is an idea compatible with ancient wisdom. Summarizing the ancient concepts, P. G. Bowen expressed it in these words: “BEING (or any Being) in ultimate metaphysical analysis is a compound of three elements, neither of which has any independent manifestation, or is knowable otherwise than in interaction with the other two. They are CONSCIOUSNESS, ENERGY, and SUBSTANCE. All three exist in everything . . .” (Bowen [1936?], 28; capitalization in the original).

Here, according to my interpretation of the ancient wisdom and beliefs, Bowen is referring to the material manifestation of the world as we currently experience it. Ultimately, I believe, consciousness is prior, and from it energy and substance manifest, but with our current sensory limitations we cannot perceive consciousness independent of its manifestation via energy and substance.

Perhaps we will someday reach a level of elevated, greatly expanded consciousness compared to that of today. Might this occur during a future cycle or age? Was this the case deep in the past? Could this be the ultimate meaning of a golden age? Was this the ideal during the Egyptian first time, during Zep Tepi?

The Ancient Egyptians may have been right all along. We come from stars and thence we return.

APPENDIX 1

WAS THE GREAT SPHINX SURROUNDED BY A MOAT?

The notion that the Great Sphinx of Egypt has its origins in extreme antiquity, dating back to at least circa 5000 BCE and quite conceivably 8000 BCE or earlier, is an argument that I have developed over two decades based on painstaking analyses of the geology of the Giza Plateau (where the Great Sphinx and Great Pyramid are located). Conventional Egyptological thinking dates the Sphinx to circa 2500 BCE, during the Fourth Dynasty of the Old Kingdom. My dating places its origins long before the rise of dynastic Egypt, back to a time when, according to the traditional paradigm, high culture and civilization did not exist.

Recently my work on the Great Sphinx has come under fire from a self-described antiestablishmentarian. Given the number of people who have been asking me about this latest "Sphinx theory," I feel it is imperative that I briefly address it here. While I eschew personal attacks and try to let unwarranted criticism of my work (typically by people lacking geological expertise but with personal agendas to defend) roll off my back, in some situations the unfounded attacks need to be addressed. This is particularly the case when the attacks are part of a weighty volume that purports to offer a new interpretation of the Great Sphinx, one that supposedly overthrows my two decades of analyses. I refer specifically to *The Sphinx Mystery: The Forgotten Origins of the Sanctuary of Anubis* by Robert Temple with Olivia Temple (2009).

Here I will first summarize Robert Temple's theory and list six major points that disprove it. I will then briefly comment on his book specifically. This discussion will not only serve to rebut Temple's ill-founded hypothesis, but also to elaborate and clarify some of the details on which my analyses of the Great Sphinx are based.

ROBERT TEMPLE'S MOAT THEORY

Robert Temple (Temple 2009; Temple with Temple 2009) has proposed a moat theory (that is, the Sphinx Enclosure was purposefully filled with water such that the body of the Sphinx was submerged and sat as a statue in a small artificial lake) to explain the clear signs of water weathering and erosion on the body of the Great Sphinx and on the walls of the Sphinx Enclosure. Temple contends that the moat theory explains the data adequately without hypothesizing that the Great Sphinx dates back to a much earlier period during which there was more rainfall than at present.

The body of the Sphinx, carved from the bedrock, sits largely below ground level, and various moat, pool, or artificial fountain hypotheses have been suggested for the Sphinx from time to time. I considered such notions carefully as far back as my early analyses of the geology of the Sphinx, starting in 1990. In summary, such moat theories and related theories do not hold water (to use a bad pun) and are not compatible with the features of the actual Great Sphinx, the Sphinx Enclosure, and the general geology and paleohydrology of the Giza Plateau.

SCRUTINIZING THE SPHINX

During a March 2009 trip to Egypt, just after becoming aware of Temple's hypothesis, I made it a point to look at the Great Sphinx and Sphinx Enclosure with fresh eyes to see if there could be anything to the moat class of theories. I will summarize briefly a half-dozen points (for more details pertaining to some of these points, as well as various comments on the criticisms of K. Lal Gauri and his colleagues of my work, as cited by Temple with Temple [2009], see Schoch 2002).

Based on my observations and analyses, the Sphinx Temple (built out of blocks removed from the Sphinx Enclosure when the body of the Sphinx was initially carved) and the so-called Valley Temple to the south of the Sphinx Temple show clear signs of heavy precipitation-induced weathering on the limestone core blocks. These limestone temples were subsequently refurbished with Aswan granite ashlars during the Old Kingdom (as evidenced by an Old Kingdom inscription still found on a block located at the Valley Temple). The moat theory

cannot explain the nature of the very ancient weathering seen under the Old Kingdom granite veneer.

There is much heavier surface erosion on the western end of the Sphinx Enclosure, and the surface erosion tapers off dramatically toward the eastern end of the enclosure. This is exactly what is to be expected based on the paleohydrology of the Giza Plateau and is incompatible with a moat theory where it is hypothesized that water was brought in from the Nile to the east. Furthermore, the nature of the surface erosion throughout the enclosure and on the body of the Sphinx is as expected if there were water running over or raining down on the rock layers. The erosion actually observed is not compatible with pooled water in the enclosure.

The highest levels of the middle member strata, as seen in the Sphinx Enclosure on the western end, are most severely eroded, which is compatible with the agency of precipitation. If the moat theory were true, then the lower strata on the eastern end of the Sphinx Enclosure would be most heavily eroded (caused by water being brought in via canals from the Nile), but the opposite is seen in reality. Indeed, the evidence is clear that the water erosion is due to precipitation and runoff, not from water and flooding of any type coming from lower elevations, such as the rising of the Nile.

The subsurface seismic data demonstrating the depth of weathering below the floor of the Sphinx Enclosure, based on my analyses (using areas excavated during the Old Kingdom for comparison), even when calibrated very conservatively, give an age of initial carving for the core body of the Great Sphinx of at least 5000 BCE. More than one geological colleague has suggested to me that a more realistic calibration gives a date thousands of years earlier. And no, it is not the case that standing water in the Sphinx Enclosure would accelerate the depth of weathering below the floor of the enclosure.

The vertical fissures observed in the walls of the Sphinx Enclosure show diagnostic signs of having been formed by precipitation and water runoff. In my opinion, they do not show any characteristics that are diagnostic or even suggestive of having been formed by artificial dredging of the Sphinx Enclosure, as some have suggested.

If the Great Sphinx actually had sat in an artificial pool or lake, either the water

level around the Sphinx would have had to have been the same as that of the surrounding water table or the walls and floor of the pool in which the Sphinx sat would have had to have been sealed up and watertight (and any artificial walls, such as on the eastern end, would have had to have been strong enough to withstand the pressure of the water). Clearly, the ancient water table was well below the level of the floor of the Sphinx Enclosure (or else the Sphinx Temple, for instance, would have been flooded). Due to the nature of the local geology (discussed under the heading "Geological Details," below), the Sphinx Enclosure could not have held a deep pool of standing water.

ANCIENT RAINS OR A MOAT?

Temple cites John Anthony West (who is responsible for my initial involvement with the Sphinx over two decades ago), Graham Hancock, and Robert Bauval as the "popular writers who have campaigned for the idea that the Sphinx is of immense antiquity" (Temple with Temple 2009, 242). Temple recounts the gist of the argument: the Sphinx shows "water erosion" (Temple's term), Egypt is known today for its desert environment, and heavy rainfall occurred in Egypt in earlier times, therefore the Sphinx must date back to those earlier times ("about 10,000 BC" is the date Temple attributes to West, Hancock, and Bauval).

Temple states his own position as such: "I was never convinced by this argument from the very beginning for the simple reason that there is just no archaeological record at all for any important civilization during approximately seven thousand years of the time postulated between the 'ancient rain' and the apparent beginnings of high civilization in Egypt" (Temple with Temple 2009, 243).

Temple's argument might have carried some weight twenty years ago, but we now have the amazing megalithic site of Göbekli Tepe in Turkey, just north of the Syrian border (admittedly not in Egypt, but certainly close enough geographically to pertain to the argument; see discussion in chapter 3). Independent of the Great Sphinx, this well-dated site provides definitive evidence that high culture dates back to at least ten thousand to twelve thousand years ago!

Temple accepts that "the apparent evidence of water erosion [in the area of the Sphinx] is so blatantly obvious to anyone that for someone supposedly knowledgeable wholly to deny it looks disingenuous" (Temple with Temple 2009, 243).

Temple proposes an alternative theory to explain the evidence: "*that the Sphinx Pit* [Sphinx Enclosure] *was once a moat filled with water, and that the Sphinx was an island"* (Temple with Temple 2009, 244, italics in the original).

Having studied the evidence for the last twenty years (I, like Temple, have had access to the interior of the Sphinx Temple, the Sphinx Enclosure, and other areas that are off limits to the general public), I feel confident in repeating my statement that Temple's moat theory simply does not hold water. I will now further elaborate on only a few salient points that counter Temple's argument.

GEOLOGICAL DETAILS

An important fact is that the current top of the westernmost end of the southern wall of the Sphinx Enclosure is at least 6 to 7.5 meters higher in elevation than the current top of the eastern end of the same wall (as can be seen on the contour map reprinted on page 534 of Temple's book). The eastern end of the enclosure includes the western wall of the Sphinx Temple, which Robert Temple believes formed the eastern wall of the moat. The actual difference between the tops of the walls is perhaps nearly twice as much when comparing the highest point at the northwest corner of the Sphinx Enclosure to the lowest point at the top of the wall in the southeast corner. Water seeks its own level, thus since we find clear and prominent evidence of water erosion at the top of the far western end of the enclosure, if the moat theory were correct, the eastern end of the Sphinx Enclosure, as well as the walls along the southern and northern sides, would have had to have reached a comparable height as the western end, up to 6 to 7.5 meters or more higher (and perhaps nearly twice that in the far southeast corner) than the walls that currently remain. These would have been substantial structures indeed to hold back the pressure of such a large body of standing water, and in sum there is no definitive evidence for such structures, although Temple argues that various constructions to the east of the Sphinx Enclosure were removed. Furthermore, such a deep pool of water would not leave any portion of the current body of the Sphinx as an island, but would submerge it

completely.

Another key point is that the Sphinx Enclosure is highly faulted and jointed. Additionally, the limestone bedrock is characterized by karst topography, with numerous openings and cavities through which water can drain. Indeed, it would leak like a sieve (another bad analogy, perhaps). To put it simply, I do not believe that the Sphinx Enclosure, even with massive walls built around it as described above, would hold a large standing body of water. The water would leak out into the numerous cavities and tunnels below the Sphinx and into the Giza Plateau more generally. In order to hold water without leaking, the bedrock and sides of the enclosure would have to be sealed up. This could conceivably have been done with some sort of mortar, cement, brick, or tile combination, but there is no evidence that this was the case. In fact, there is clear evidence that the rock forming the sides of the enclosure was left bare. If the rock had been covered, sealed, and protected, then it would not show the well-developed water erosion features that we observe to this day and that even Temple puts so much stock in. Furthermore, if the enclosure had been sealed in such a manner, this would not be compatible with the dredging theory, advocated by Temple, to account for the vertical fissures. These features and their distribution are the signs of rain and water runoff from higher up on the plateau to the west and north; they are incompatible with a moat theory.

In his book, Temple misrepresents various geological details, convoluting the facts to prop up his moat theory. For instance, he includes a photograph of what he refers to as “the swirling pattern in the rock where the water entered from the channel and then passed to the right into the open Sphinx Moat” (Temple with Temple 2009, 271). The features shown in the photo are actually nothing of the sort. They were formed millions of years ago due to mineralogical and chemical migration as the layers of limestone, which originally formed at the bottom of an ocean, were gradually uplifted and the water table receded. K. Lal Gauri and J. K. Bandyopadhyay explain this point in their book *Carbonate Stone* (1999), a work that Temple cites but perhaps did not read carefully.

SUBSURFACE WEATHERING

Temple clearly and purposefully misrepresents my work when he writes, “There is one other major point in Schoch’s book with Robert Aquinas McNally [*Voices*

of the Rocks (1999)] that should be mentioned. He says that he determined through his geological investigations of the Sphinx Pit that there was deeper erosion to the north, south, and east of the Sphinx in the floor of the moat than there is to the west. This discovery substantiates the hypothesis of a moat fed from the east by the Nile" (Temple with Temple 2009, 289).

To put it simply, this is a complete fabrication on the part of Temple! What I wrote, which is also explained in detail in the academic paper that Thomas Dobecki and I (Dobecki and Schoch 1992) published but Temple never cites, although I list the reference in *Voices,* is this: "The north, south, and east floors of the trench surrounding the east-facing Sphinx are weathered to a depth of six to eight feet [approximately 1.8 to 2.5 meters] below the level of the enclosure's currently exposed surface. On the monument's western end, the Sphinx's rump, the weathering extends to only four feet [1.2 meters]" (Schoch with McNally 1999, 40).

Self-styled expert on geological erosion and weathering that he is, Temple must clearly know the difference between surface erosion (the breakdown and removal of material) and subsurface weathering (mineralogical changes without substantial removal of material). While the surface erosion is more pronounced on the western end of the Sphinx Enclosure, where the rocks are topographically higher and caught the brunt of rainwater runoff from the plateau in the period prior to dynastic times, the subsurface weathering below the floor of the Sphinx Enclosure is shallower on the western end. This does not support Temple's moat theory at all, but in fact contradicts it.

If the moat theory is correct, with water flowing in from the east, then the surface erosion, and not the depth of subsurface weathering, should be greatest on the eastern end. Since the floor of the Sphinx Enclosure is more or less at the same elevation across its surface, water entering from the east would quickly reach the western end (again, water seeks its own level), and once a meter or so depth of water was in the enclosure, the entire floor would be covered with water. Furthermore, the depth of the subsurface weathering is not dependent on the surface being covered with water. The depth of subsurface weathering is a function of how long ago the rock floor was exposed, not how much water has flowed over it.

The reason the subsurface weathering is less deep on the western end is that originally the rump of the Great Sphinx was carved down only to the depth of the lower ledge or terrace directly behind the Sphinx. Originally the Sphinx emerged from the bedrock. The sides and eastern portion show deeper subsurface weathering because they were totally carved down to the current floor of the Sphinx Enclosure thousands of years earlier than the rump, which, based on my analyses, was fully carved down to the current floor as part of the refurbishing of the statue during Old Kingdom times, circa 2500 BCE.

SPHINX OR JACKAL? LION OR DOG?

A major thesis of Temple's book is that the Great Sphinx was not originally a sphinx, but a jackal (wild dog) representing the god Anubis. Traditionally the body of the Sphinx has been viewed as that of a lion, and I (among others) have suggested that originally it was a statue of a lion. Temple argues that the body of the Sphinx cannot represent a lion because its back is flat and straight, whereas a lion has a massive chest and the back rises to the front. Temple contests that the straight back of the Sphinx matches that of Anubis as a jackal in its characteristic crouched pose with its forelimbs stretched before it. This may be so, but for me it is a moot point.

The body of the Sphinx is highly weathered and eroded, and I believe that the current flat state of its back is primarily a function of a flat geological bedding plane level, down to which the rock has eroded (I have had the opportunity to walk on the back of the Sphinx and inspect it closely). The flat back is not how it was originally carved. Indeed, no significant original carved surfaces on the body of the Sphinx remain exposed for inspection. The body's surface is entirely weathered and eroded, in many places by a meter or more, and we just do not know what the exact original outlines of the body looked like. However, the curving tail on the right side of the body of the Sphinx, reconstructed in limestone blocks that have been used to fill in and repair the erosion, is much more leonine than jackal-like (in ancient Egypt, Anubis as a jackal generally had a straight tail, often hanging down, very unlike the current curved tail of the Sphinx). I do not believe that we can definitively say what the original body of the Great Sphinx looked like, but it certainly is compatible with that of a lion.

The current head of the Great Sphinx is clearly that of a human, and the modern, conventional Egyptological view is that the face represents the Old Kingdom pharaoh Khafre, reputed builder of the Great Sphinx in circa 2500 BCE. I have made it very clear in my work that I do not believe the current head of the Great Sphinx is the original head. It is proportionally too small for the body and has been recarved. Furthermore, I have been explicit in suggesting that the current head of the Great Sphinx is not that of Khafre, and I discuss this at length (citing the work of the forensic expert Frank Domingo) in *Voices of the Rocks* (Schoch with McNally 1999), yet Temple (Temple with Temple 2009, 288) suggests that I believe the face of the Sphinx is that of Khafre. The truth is that I have suggested that the current pharaonic head is a recarving, perhaps dating to early dynastic times (Temple dates the current head to the Middle Kingdom, asserting that the face seen on the Sphinx is that of the Middle Kingdom pharaoh Amenemhet II, nineteenth century BCE). Since Temple ostensibly read my book, either he suffered from a lapse of memory or he is purposefully misstating my position.

Temple suggests that originally the head on the Great Sphinx was that of a jackal, with elongated snout and upright pointed ears. The current head, according to Temple, was recarved from the neck portion of the original jackal head. Studying the original statue, there is really no way to confirm Temple's hypothesis of a jackal head, but from my perspective as a geologist, it seems highly unlikely. According to Temple's hypothetical reconstruction, the missing jackal ears situated above the level of the current head were over nine meters tall, and the face and snout of the jackal extended out from the current face by over nine meters. While the dolomitic limestone from which the head is carved might have been able to support a pair of nine-meter-tall vertical ears, I question whether the rock would have been strong enough to support a nine-meter projecting face and snout without anything propping it up from underneath. At best, positing a jackal face on the statue is wild speculation and highly questionable.

THE GRANDEUR OF THE GREAT SPHINX

All in all, after poring through Temple's book, my conviction that the Great Sphinx has its origins thousands of years before dynastic times remains as strong as ever. Furthermore, unless better evidence than that which Temple presents

comes along, I will continue to think of the Great Sphinx as a sphinx or as a lion that was later recarved with a human head. The nobility, the grandeur, and the mystery of the Great Sphinx remain intact.

APPENDIX 2

POLITICS, MONEY, AND SCIENCE

Despite the myth of the "objectivity" of "pure science," there is nothing fully objective about the way practicing scientists actually pursue their business. Scientists, like everyone else, are influenced either subtly or explicitly by combinations of social, political, and religious pressures (even when reacting against such factors) and by deeply ingrained assumptions and worldviews that are virtually inescapable. The status quo rewards "good" scientists, those who toe the party line, with prestige, honor, promotions, grant money, personal gain, and even wealth. But those who step out of line may be severely punished.

As science historians Juan Miguel Campanario and Brian Martin (2008) have pointed out, there are different strategies one can pursue as a scientist (or academic scholar more generally). Most scientists build their careers by accepting, and working within, the existing paradigm of the time, adding to the overall picture with carefully sifted bits of data and perhaps elaborating and slightly tweaking existing theories. The work they do is neither highly original nor spectacular, but in terms of peer acceptance and likelihood of success (whether measured in terms of contributions to the paradigm or, more honestly, promotion and upward mobility in terms of jobs and salaries) it is a good, conservative approach. Such a path, herding with the scientific pack, generally results in a stable career, moderate prestige, and the material benefits that go with being a well-paid industrial or academic scientist.

On the other hand, we can consider the "scientific risk-takers," those who pursue speculative or unusual ideas, do not dismiss anomalous data, and end up questioning the reigning paradigm. The stakes are high. If the dissident succeeds in having a new idea or theory accepted by the mainstream, the rewards in terms of prestige (which may result in funding, jobs, or other material benefits) can be enormous. However, the odds are stacked against the true innovator, and such a path is difficult, to say the least. Not only, one can argue, is there a high

probability that the theories or ideas espoused by the innovator are false in an absolute sense, but even if there is something to them, there is also an incredible prejudice against new ideas among status quo scientists. As the Nobel Prize–winning physicist Max Planck (1858–1947), one of the founders of quantum mechanics, famously asserted, "A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it" (Planck, quoted in Kuhn 1962, 150).

POLITICS AND SCIENCE

Politicians often have the ability to halt the serious pursuit of certain scientific endeavors. This has been the case for thousands of years. Hero of Alexandria (first century CE) was well on his way to developing an effective steam engine. However, the politicians and administrators wanted nothing to do with such a device. The Roman Empire widely employed slave labor. If mechanical engines were used to irrigate fields or for other aspects of production, what would all those slaves do? Idleness could lead to rebellion. The first practical steam engine would have to wait another 1,600 years. Imagine what the world might be like today if the politicians had not squelched the invention of the steam engine two thousand years ago.

The patron of science, or of a particular scientist or field, can be all-important. A classic example is the Soviet agronomist Trofim Lysenko (1898–1976), who gained the personal support of the dictator Joseph Stalin (1878–1953). Lysenko rose to prominence in the 1920s, garnering the attention of the Soviet leaders as someone ideologically compatible with the politics of the time. Lysenko had peasant roots; he despised classic academic theory and mere laboratory work, emphasizing practical techniques to increase crop yields. Lysenko was given the helm of the Academy of Agricultural Sciences of the Soviet Union and named director of the Institute of Genetics of the USSR Academy of Science. His anti-Mendelian, neo-Lamarckian (inheritance of environmentally acquired characteristics) views received high-handed official approval. Statutes outlawed dissenting opinions. In the end, Lysenko's "science" proved ineffective; many of his supposed results were either greatly exaggerated or simply fraudulent. Lysenko may be an extreme case, but it illustrates the abuses possible when those with power and money decide to support an agenda using science as the means.

On a different scale, I have seen the corrupting effects of money in Bosnia. I am referring to the so-called Bosnian Pyramids located in the region of Visoko. Initially I was excited about the prospect of very ancient pyramids (claims circulated that they were ten thousand or more years old). Upon visiting the site, I discovered a massive hoax fueled by money, power, influence, and patronage. The major player is Semir Osmanagich, a Bosnian-American who continues to promote several natural hills as human-made ancient pyramids. He has solicited private, corporate, and government backing and funds to continue "excavations" there, excavations that only perpetuate the fraud by actually shaping the hills into what appear superficially to be step-pyramid structures. Osmanagich brings high-level politicians to the site, touting the great "discoveries" being made, and organizes "conferences" about the "pyramids."

While in Visoko exploring the site firsthand in 2006, I briefly met a former head of state of Yugoslavia, there to support the "pyramids" (Bosnia and Herzegovina is one of the countries that resulted from the breakup of Yugoslavia during the 1991–1995 wars), and I attended one of Osmanagich's conferences. The conference was a farce, with no hard evidence corroborating the reality of the "pyramids," but rather a lot of mumbo-jumbo and ambiguous comments generated by people claiming to be scientists (archaeologists, geophysicists, chemists, geologists—you name it), who were present simply because they were being paid and jobs were difficult to come by in the ravaged Bosnian economy. The politicians apparently knew nothing about science and cared even less. All they were concerned about was bringing in money, and the so-called pyramids formed a major tourist attraction, with small businesses, restaurants, and hotels sprouting up to serve the needs of the pilgrims to the site. And pilgrims they were, for they were coming to a virtually sacred spot, one that engendered national loyalty and pride in the antiquity and sophistication of Bosnia's origins —supposedly older than Egypt or perhaps any other civilization. To question the authenticity of the Bosnian pyramids was to insult the Bosnian people and their heritage. Nationalism can trump scientific evidence and reason. The paradigm, the accepted dogma, in the case of the so-called Bosnian pyramids was that they are authentic. Evidence to the contrary was ignored, or worse yet, those advocating a different view were vilified and persecuted. I was reminded of the Inquisition.

This brings us to a major problem with science today: the dominance of

certain ruling paradigms. Those who control the money, jobs, prestige, technical publication outlets, and popular media (whether directly or subtlety) have a low tolerance for ideas that may challenge the desired result or accepted status quo. It seems that in the modern world if one wants to be sure to fit in, one does not question certain sacred cows. Among these are human-induced global warming, Darwinian evolution, gradualism, global plate tectonics, big bang cosmology, various aspects of materialism, and historical progressionism (the general concept that history is a one-way street going from dumb old "them" to modern, enlightened, technologically sophisticated "us"). Various other topics are anathema and shunned by any "serious" scientist who expects to receive grant funding; desires a decent university, government, or corporate position; and entertains the prospect of publishing in the most prestigious scientific journals, which in turn are taken by the popular media as presenting dogmatic truth worthy of reporting. Shunned subjects include nontraditional medicine, crop circles, UFOs, intelligent design, alternative archaeology (including the concept that some ancient peoples were much more sophisticated than traditionally believed), and paranormal (parapsychological) studies.

Parapsychology is an interesting case. Telepathy (direct mind-tomind communication), psychokinesis (mind-over-matter), and precognition (reception of information about future events) have been studied extensively for more than a century by some of the best minds, including Ph.D.-level scientists and even Nobel laureates (for example, Charles Richet, Nobel Prize in Physiology/Medicine, 1913, and Brian Josephson, Nobel Prize in Physics, 1973). The basic phenomena have been demonstrated over and over again, and even been put to practical use (see Bem 2011; Bremseth 2008; Burns 2003; de Martino 1972; de Vesme 1931a, 1931b; Laszlo 2003, 2004; Myers 1903; Owen with Sparrow 1976; Utts 1991; and articles in Schoch and Yonavjak 2008).

There is a vast body of scientific literature on parapsychology, with specialized journals and societies. Yet, despite these facts, the "average scientist" does not consider parapsychology a science and, knowing nothing about the subject and its evidence, feels free to make disparaging statements about the field and any of its practitioners. If anything concerning parapsychology makes it to the popular media, the press is sure to interview some mainstream "acknowledged authority" and will be fed a bunch of rubbish supposedly debunking parapsychology. To belittle parapsychology even more,

the media may include comments about crystal balls, fortune-tellers, false séances, or quack astrologers (versus true astrologers), thus further condemning parapsychology by association.

This attitude toward parapsychology is not new. Discussing telepathy, the great Russian ethnographer Sergei Mikhailovich Shirokogoroff (1889–1939), who studied at length the culture of the indigenous people of the Siberian region (whom he labeled the Tungus) during the early twentieth century, wrote:

> Transmission of thought at a distance was observed by several authors and interpreted in different manners. . . . Some time [a]go any one who dared to discuss these questions or to publish the facts met with criticism from the "scientists" who said that these were "superstitions," "folklore," "immaterial approach," "lack of criticism," etc., while they themselves were merely impressed by the existing theories and hypotheses accepted as "truth". As a matter of fact such a behavior of scientists is as much ethnocentric as that of the Tungus and it is as much "folklore" as that designated as such by the scientists. (Shirokogoroff 1935, 118, footnote)

That is, to uncritically dismiss evidence (in this case, evidence supporting the reality of telepathy) as impossible—therefore it must be superstition or folklore—is in fact just a modern form of bias that supports the preconceptions of the modern scientists.

People who consider it their duty to maintain the status quo often attempt to dismiss ideas and data that counter their limited worldview with overly simplistic, patronizing remarks. One of their favorite mantras is along the lines that "extraordinary claims require extraordinary evidence." This is an assertion that may sound superficially profound, but it does not hold up under careful and logical scrutiny as, when typically applied by the debunkers, it presupposes what is extraordinary in terms of claims and then sets an evidential standard that precludes the possibility of the claims being validated, no matter what the evidence. To give an extreme example, the nineteenth-century physicist and physician Hermann von Helmholtz (1821–1894) declared that no amount of evidence, not even the evidence of his own senses, could ever convince him that telepathy is real since he knew that it was impossible (see Schoch and Yonavjak 2008, 331). Talk about close-minded!

Given its low status, parapsychology has never been the recipient of adequate

funding. In the early 1990s it was estimated that the total expenditures devoted to parapsychological studies worldwide since 1882 (the year when the Society for Psychical Research was established, thus beginning systematic scientific studies of the paranormal) were at most equal to two months of psychology funding in the United States. In the last twenty years the situation has only become more dire as the Princeton Engineering Anomalies Research (PEAR) laboratory has shut down and the United States government and military are no longer (at least not publicly) funding parapsychological research or applications.

Between 1972 and 1995 the CIA (Central Intelligence Agency), the DIA (Defense Intelligence Agency), INSCOM (U.S. Army Intelligence Support Command), the NSC (National Security Council), and other federal departments funded, studied, and applied parapsychological techniques to military and intelligence objectives (Bremseth 2008). During the Iran hostage crisis (1979–1981), under the Carter administration, remote viewing was successfully used to identify American hostages and their locations as well as potential escape routes. In his book, *White House Diary* (2010), Jimmy Carter mentions the successful use of parapsychology-based intelligence, stating, “The proven results of these exchanges between our intelligence services and parapsychologists raise some of the most intriguing and unanswerable questions of my presidency. . . . They defy logic, but the facts are undeniable” (Carter, quoted by Gavin 2010).

If there is scientific evidence supporting the reality of parapsychological phenomena and, more important, they actually work, as testified to by a former U.S. President, why did the government stop funding such studies? Why is parapsychology held in such low regard by the scientific community and the public at large? Why is there so much disinformation about the subject? Shouldn’t substantial funds be put into such a paradigm-breaking subject?

THREATENING THE PARADIGM

I believe the “problem” with parapsychology is indeed its paradigm-breaking aspect. The data of parapsychology suggest the possibility that mind can exist and operate independent of matter, that consciousness is a force or entity unto itself that can interact with other consciousnesses and also directly affect the material world. These concepts strike at the very foundations of a materialistic, progressive worldview, where everything can be explained by a combination of

physical forces mixed with random accidents. The status quo "scientific" worldview typically leaves no room for a dualism between spirit and matter, nor even acknowledges the concept of spirit or soul as having an objective reality. To make matters worse, parapsychology takes seriously such issues as the possibility of an afterlife, discarnate spirits, and the idea of consciousness (at some level) pervading all of life and the universe.

It would seem that everything parapsychologists study and find evidence for threatens the status quo currently benefiting those in charge. Modern society is built on materialism and consumerism; those with the most money have the most influence (be it in politics, business, or otherwise) and reap the material benefits of society. They want to keep it that way. Superficially it might appear that the relationship of parapsychology to religion would be more amicable, but such is not the case when it comes to many mainstream churches. Based on subservience to a god, with the intermediaries between the god and the everyday public being the officials of the church, there is little room for freedom of thought when it comes to the nature of spiritual beings, consciousness, and our souls. The dogma of the church (whichever church) should prevail and be accepted on blind faith without scrutiny.

While parapsychology is an example of a field shunned and disparaged by the mainstream, an example of a paradigm and dogma currently favored by the establishment scientific community is anthropogenic global climate change. The consensus view is that Earth is warming, with potentially disastrous consequences, and the primary culprit is human activity. In many scientific circles, to even suggest that this may not be the entire story is to face harsh consequences—loss of grant funding, diminished prestige, being passed over for promotion, inability to publish one's data and views.

The American Physical Society (APS), like many other scientific societies, has gone on record as supporting the reality of global warming, stating (language adopted by the APS Council on November 18, 2007):

Emissions of greenhouse gases from human activities are changing the atmosphere in ways that affect the Earth's climate. . . .

The evidence is incontrovertible: Global warming is occurring.

If no mitigating actions are taken, significant disruptions in the Earth's physical and ecological systems, social systems, security and human health are likely to occur. We must reduce emissions of greenhouse gases beginning now.

Because the complexity of the climate makes accurate prediction difficult, the APS urges an enhanced effort to understand the effects of human activity on the Earth's climate, and to provide the technological options for meeting the climate challenge in the near and longer terms. . . . (American Physical Society 2011)

Of course, such statements issued by mainstream scientific organizations become dogma virtually equivalent to papal encyclicals. They form the basis and rationale for investing major financial resources in the topic—in this case global warming.

Charges of academic misconduct on the part of climate change proponents made the news with the scandal dubbed "ClimateGate." In November 2009 more than a thousand e-mails and several thousand documents were released by a hacker, acquired from a server used by the Climate Research Unit of the University of East Anglia. Allegations included the withholding of data, manipulation of data to support global warming scenarios, exaggeration of the certainty of the data supporting global warming, suppression of dissenting opinions, and plotting to remove from influential positions people (such as journal editors) who disagreed with climate change dogma. Subsequent investigations into these charges have neither fully supported the allegations nor totally exonerated the individuals involved, but they have engendered strong feelings and exposed just how vested the interests are and how much money can be at stake.

On October 6, 2010, Harold Lewis, emeritus professor of physics, University of California, Santa Barbara, sent a letter to the president of the APS, resigning in disgust from the society he had first joined sixty-seven years earlier. Professor Lewis asserts that the APS (and by extension, much of mainstream science) has been corrupted by money. To quote him:

The money flood has become the raison d'être of much physics research, the vital sustenance of much more, and it provides the support for untold numbers of professional jobs. . . . It is of course, the global warming scam, with the (literally) trillions of dollars driving it, that has corrupted so many scientists, and has carried APS before it like a rogue wave. It is the greatest and most successful

pseudoscientific fraud I have seen in my long life as a physicist. Anyone who has the faintest doubt that this is so should force himself to read the ClimateGate documents, which lay it bare. (Lewis 2010)

Even if one disagrees with Professor Lewis that global warming is the “most successful pseudoscientific fraud,” his point that money drives much of modern science must be acknowledged. Those who control the money influence the science, both in terms of which topics are researched and, it would appear in at least some instances, the conclusions that are reached.

Here I am not judging the sides in the global warming debate. Personally, I am convinced that the bulk of the evidence indicates that Earth is warming. However, it appears to me that both natural and artificial factors are involved, and it is difficult to disentangle the two. Nature is not as simple as some people’s thinking may be. This is true when it comes to global climate change, the interplay between matter and consciousness, evolution (evolution occurs, but is both more subtle and more complex than some simplistic formulations), or any of a myriad of other scientific issues. Even such subtleties, however, seem to threaten the status quo. Unfortunately all too often dogmatism prevails and any freedom of thinking is confined to very narrow limits, at least if one wants to gain prestige, influence, and money while pursuing science.

APPENDIX 3

A NOTE ON THE NAMING AND DATING OF THE END OF THE LAST ICE AGE

The final period of the last ice age is referred to as the Younger Dryas (circa 10,900 BCE to circa 9700 BCE). To place this into context, during its 4.5-to 4.6-billion-year history the Earth has undergone various periods when there were ice ages, extremely cold conditions, on the surface of our planet. The last such period (most recent period of ice ages) is known as the Pleistocene Epoch and dates from about 2.6 million years ago to the end of the Younger Dryas, about 9700 BCE. The period since the end of the Pleistocene, the period that we currently live in, is known as the Holocene Epoch. During the Pleistocene there were major fluctuations in climate and temperature, glaciers came and went, and there were glacial periods and interglacial periods (all of which have been given various technical names that we need not go into here). Arguably, the comings and goings of glacial and interglacial periods has not ended, and the current Holocene Epoch might better be considered merely the latest interglacial period. Only time will tell.

Why is the very end of the last ice age called the Younger Dryas? This period is named after the plant *Dryas octopetala,* whose remains are commonly found in sediments (typically as pollen grains) dating from this period. *Dryas octopetala*, which is still with us today, is an arctic-alpine member of the rose family that thrives under cold conditions at high altitudes and latitudes throughout the Northern Hemisphere (Ladyman 2011). During the last ice age, when times were colder and forests contracted, the range of *Dryas octopetala* expanded. Today it grows as a low evergreen shrub with leaves that resemble those of oak trees, hence it was named *Dryas* after the mythical Greek oak-nymphs, the dryads. The flowers are white (or very rarely, slightly yellowish) and typically have eight petals (thus the name *Dryas octopetala,* referring to eight petals). Common names for the species include mountain avens, white

dryas, white dryad, alpine dryad, and white mountain avens.

If there is a Younger Dryas, is there also an Older Dryas? Yes. And indeed there is even an older period than the Older Dryas, known as the Oldest Dryas. The Oldest Dryas may date back to 17,000 BCE or 16,000 BCE, and the Older Dryas is intermediate in age between the Oldest Dryas and the Younger Dryas. The details of the dating of the Oldest and Older Dryas are contentious.

In this work I have generally referred to the end of the last ice age, or more specifically the end of the Younger Dryas, as dated to circa 9700 BCE and the beginning of the Younger Dryas as circa 10,900 BCE, following the chronology of Steffensen *et al.* (2008). Others use different dates for these events, dates that may appear to be disparate by centuries. So, for instance, LaViolette (2011a) adopts a chronology that dates the end of the Younger Dryas to 11,543 BP (that is, either 9593 BCE or 9543 BCE, depending on whether "before the present" is considered before 1950 CE or 2000 CE, as both are used by various researchers) based on data from a sediment varve core (varves are thin layers of silt and clay deposited in lakes, often on an annual basis) from the Cariaco Basin (off the coast of Venezuela), which LaViolette equates to a date of 11,610 BP in certain Greenland ice core chronologies. That is, the 11,543 BP date is the same as the 11,610 BP date. This may seem like an error, but in fact it is very difficult to place precise calendar year dates on prehistoric and geological events. To give another example, in an October 2009 online update to his work, in a footnote LaViolette writes, "As of the time of this update (10/09), LaViolette has adopted the date 12,887 calendar years b2k. [before the year 2000 CE] (~11,000 C-14 years B.P. [before the present]) as the climax of this megafaunal extinction. PAL [Paul A. LaViolette]" (LaViolette 2011b). Here he is referring to the major extinction of many large mammals and other animals at the beginning of the Younger Dryas and equating a "classic" date of eleven thousand years ago (which some would translate as 11,000 – 1950 = 9050 BCE) based on radiocarbon dating with 10,887 BCE (that is, 12,887 years before 2000 CE).

Of course, sometimes errors do occur. To give an example also taken from LaViolette (and I note that this is not LaViolette's error), in 1985 he published a major study of cosmic dust concentrations in an ice core that had been dated to the latter portion of the last ice age, circa 14,000 to 20,000 years BP. After LaViolette's work, however, the ice core he analyzed was redated to circa 38,650 to 78,500 years BP. Thus LaViolette's careful analysis referred to an

entirely different period during the last ice age (see LaViolette 1985).

Years based on sediment layers such as varves or based on what is assumed to be the annual layering of snow or ice deposits may not always be exact (there can be loss or misinterpretation in the record). Likewise, isotopic techniques have errors of various kinds, including how to calibrate the dates. This has been a particular problem with the popular radiocarbon dating (based on the radioactive isotope ^{14}C). Uncalibrated radiocarbon dates can differ dramatically from calibrated radiocarbon dates, and various calibrations can result in different apparent absolute dates (absolute dates are dates in the past based on modern calendar years). Also, in some cases there have been anomalously young, by thousands of years, radiocarbon dates reported for some apparent ice age (Pleistocene) animals, such as a date of about 4000 BCE for a mastodon tusk from Michigan (Skeels 1962, 123). Generally it is believed that mastodons were long extinct at that time. To account for some such anomalous dates, LaViolette has suggested, “If a super SPE [solar proton event] had occurred as proposed and caused the ground level cosmic ray intensity to reach very high levels in certain geographic locations, this could explain why some megafaunal remains have anomalously young radiocarbon dates uncharacteristic of the strata age they are found in. That is, incident solar cosmic ray protons could have generated thermal neutrons within animal tissues which upon colliding with organic nitrogen could produce radiocarbon in situ in the animal remains” (LaViolette 2011a, 11, footnote).

Another possibility, in some cases at least, is that anomalously young dates could be due to simple intrusion of contamination containing younger carbon, or in the case of the mastodons, there may have been relict populations living much later than is generally assumed. Or in the case of the young mastodon cited above (which is an example cited in LaViolette 2011a), note that the date of the original paper is 1962; techniques have been refined since then. The bottom line is that such dating is fraught with many difficulties, and it is often unrealistic (and unreasonable) to expect (or demand!) precise and accurate dates in calendar years.

Not long after publishing a paper in which I referred to the end of the last ice age as around 9700 BCE, I received an e-mail from a well-meaning “fan” politely informing me that I was mistaken, the ice age ended in 9550 BCE. I

could only smile to myself as I thought about the writer's naïveté when it comes to geological dating. The truth is that we cannot necessarily pinpoint the exact age in years of the end of the last ice age (either 9700 BCE or 9550 BCE, or some other date around the two) or any other event that long ago, but we can determine approximately when events occurred and, more important, we can attempt to determine chronologies and sequences of what came earlier, what came later, and what occurred simultaneously. Thus geologists do not commonly speak in terms of years, but in terms of events. The "end of the Younger Dryas" (which is the same as the end of the last ice age) is an event in time, whatever years are associated with it by one researcher or another (for a further discussion of chronologies and dating in geology, see Schoch 1989).

So, the bottom line I would like to impress on readers regarding dates from long ago is this: take all calendar year dates with a large grain of salt, but when I speak of the end of the last ice age (the end of the Younger Dryas), for instance, I am referring to an event and time in history or prehistory that is more or less equivalent from one author or researcher to another regardless of the calendar years they ascribe to it.

APPENDIX 4

MOVING THE MOAI

Easter Island and Psychokinesis

Here I will explore the possibility that parapsychological insights into modern psychokinesis combined with a particular theory of gravity may provide a major clue to the mechanism underlying psychokinesis and ultimately perhaps to how the moai were moved. Admittedly this discussion is nonconventional, even radical and outrageous to some, but I believe it is at least heuristic to consider.

GRAVITY AS AN ENTROPIC FORCE AND A THEORY OF PSYCHOKINESIS

In a recent paper Erik Verlinde, of the Institute for Theoretical Physics, University of Amsterdam, has developed the idea that gravity is not a fundamental force, but rather "an entropic force caused by changes in the information associated with the positions of material bodies" (Verlinde 2010, 1). Verlinde develops this theory in the context of a holographic concept of the universe, where the commonly understood structure of space-time is in fact an emergent property of information that can be visualized as stored on a surface or screen that wraps around the universe. In this conception, mass emerges from information on the holographic screen surrounding a region (even if we conceptualize that region as the entire known universe). Note: entropy is the degree of disorder within a system.

In the last paragraph I have tried to do justice, in quite abbreviated form, to Verlinde's thinking. Now I will develop it a bit further, and I will first state that my thoughts are an outgrowth of reading Verlinde's paper, but second, he may well not agree with my analyses, interpretations, and speculations!

To say that gravity is an entropic force is fundamentally saying that gravity as we observe it arises from the tendency of a system (which could be the entire universe) to statistically increase in entropy. Again, entropy is basically disorder within a system, and by the second law of thermodynamics, the entropy of an isolated nonequilibrium system will increase over time (that is, its order decays). A common everyday example of an entropic force is the pressure of a gas as the particles (atoms and molecules) spread out; a cellular example is the pressure of an osmotic gradient. If gravity is an entropic force, essentially the gravitational force is the tendency of objects (whatever objects are, as they may be epiphenomena) to move to positions of maximum disorder. Disorderly systems carry less information and orderly systems carry more information. Gravity can be equated with the tendency toward increasing entropy, which is increasing disorder, which in turn can be equated with minimizing informational content. Ultimately to "overcome" gravity, to act against the force of gravity, entails a change in the information content of a local system. In the everyday common "real world" we might change the information content of an object, say a stone, by physically lifting it up and placing it on a shelf. If it should be disturbed and fall down off the shelf, the local information content (ultimately encoded and stored on a holographic surface) would change once again.

In an ultimate sense, in a system completely lacking in information (no data encoded on the holographic screen), there would be no gravitational force as there could be no entropic force since minimal information and thus maximal disorder (entropy) would be the state of the system. One could visualize such a system as completely collapsed down to a single dimensionless point, but since there is no information in the system, there would be no mass (since mass emerges from information) or space-time. If information were to be inserted into the system, mass and space-time would emerge, and also gravity as an entropic force countering the information (statistically driving the system back to maximum entropy and minimum information). Information would create the universe as we know it, and inserting increasing amounts of information into the system would cause the universe to expand outward even as gravity countered the information tendency.

The most fundamental aspect of the universe, by this conception, is information (see also discussion in the box, "From Stars We Come and Thence We Return,"). Information may be equated with thought or mind or mental

constructs independent of any material everyday conception (certain aspects of parapsychological studies strongly support the notion of the independence of thought or mind from any kind of material object, like a physical brain). The universe of mass and energy and forces, as we experience it on an everyday practical level, may have had its origin in a thought that inserted information into an otherwise blank (datafree) holographic system. (I will leave the question unanswered as to where the initial thought came from, although I cannot help but think of the famous lines from the Christian scriptures, “In the beginning was the Word [thought, information]: the Word was with God and the Word was God” (Jerusalem Bible, 1968, John 1:1). Inserting more thoughts, more information, expands and changes the system, allowing it to develop or evolve. Furthermore, thoughts at a certain level are self-perpetuating (here the memory of thoughts, the encoding and preserving of information, may play a key role) and self-expanding as they build, grow, and elaborate on themselves, and in this scenario they are all the while building and developing the “material world” and universe as we know it. Thinking entities who accept the epiphenomena of the everyday world as they experience it on a mundane level will put out more thoughts (habits of thinking), which indeed reinforce not just their status quo conception of the world but also literally their experiential world. Once thinking entities accept a particular worldview (including a conception of the world at the most fundamental level, such as the basic laws of physics), it will be self-perpetuating until or unless different information (thoughts) is inserted into the system at the most fundamental level.

So, by this hypothesis, inserting or changing information by mental means, by thoughts alone, can change (add to, rearrange, and integrate) the data on the holographic screen that “creates” the universe as we know it, and thus we can change the universe or some localized region or sector of the universe. In particular, changing information may allow gravity to be overcome, and this is precisely what we see in genuine cases of psychokinesis. However, the key (or “trick”) is actually changing the information. It seems clear that it is not enough (at least for the vast majority!) to simply “think” on a conscious level about producing a psychokinetic event, but a very deep unconscious or subliminal “belief” (for lack of a better term at the moment) must be present for information to be changed such that manifestations occur in the everyday “real” world. Furthermore, successfully injecting or modifying information so as to manifest observable changes may also require a collective level of belief, or at the least overcoming the collective disbelief (perhaps by the force of the “belief” of a

single or few individuals), in a local system.

Among the best-documented cases of mind over matter (the movement of objects by nonphysical means) are so-called poltergeist instances (Roll 2003). In many such cases it appears that objects are moved paranormally (items thrown through the air or falling off of shelves when nobody is close enough to reach them and no physical means are apparent to account for the movement of the objects) due to the unconscious emanations of an emotionally or psychologically disturbed individual. In these instances the person who is the source or focus of the poltergeist manifestations may have, at a deep unconscious level, broken ties with everyday reality, and as a result he or she is able to successfully change information in the holographic system, which results in manifestations in the "real world" that defy normal gravitational constraints. Other cases of genuine levitation, movements of objects, and other gravity-defying and psychokinetic phenomena (even to move an object horizontally, without perceptively lifting it vertically, can involve overcoming the force of gravity to some extent) have been documented in séance-type settings where a critical mass of the participants (it is not clear if 100 percent is always necessary) have apparently either allowed themselves at a deep level to "believe" that such things can occur or at least have gotten to an open attitude of suspension of disbelief (so as not to unduly hinder the process).

As a case in point along these lines, in 1869 and 1870 a committee of the London Dialectical Society investigated so-called spiritualistic phenomena, including experimenting with "séances." Some of the investigators were apparently skeptical but open-minded, and on numerous occasions a heavy table, for instance, was witnessed to move in various directions without any human contact or other mechanical or physical explanation (London Dialectical Society 1873). Many other cases of levitations, movements of objects, and other physical phenomena are recorded in the serious literature (Owen with Sparrow 1976; Braude 2008; de Martino 1972).

Another context where psychokinesis appears to be well documented is on the microscopic or atomic level, for instance, influencing the rolling of dice or the actions of random event generators (Rhine and Rhine 1943; Jahn 1996; Burns 2003; Schoch and Yonavjak 2008, and references cited therein). In such cases, I hypothesize, it may be that it is easier to "believe" that psychokinesis

can occur on a microscopic or atomic level, and therefore it is easier to insert or change information in the system, overcome entropy, and effect real changes manifested in the observable world.

In some cases it has been claimed that individuals can manifest macroscopic psychokinetic effects by conscious will or volition. An example of such an individual was the Russian Nina S. Kulagina (Kulagin 1971; Vilenskaya, 1995). I have to admit that I remain highly skeptical of reports of individuals who it is claimed can perform macroscopic psychokinetic feats on command, and I cannot vouch for the authenticity of Kulagina's phenomena, but it is instructive to consider her case. Typical for Kulagina was the movement of small and light objects, such as earrings, rings, envelopes, and such, across a tabletop; a 1971 report stated that the largest object moved was a glass vase weighing 380 grams. In order to effect positive results, Kulagina had to be in a suitable psychological state.

It was discovered that even the psychological state of the persons witnessing the experiment was of importance too. Interest, open mutual trust and friendly feelings are very helpful for the experiments. In cases when the initiative for the experiments did not come from the subject, when the circumstances were unfamiliar and the experiment organised in a different way, e.g., new apparatus, new objects, strangers present, then it is difficult to get good results. In such cases, the subject has to exert more energy, takes longer to prepare the test, and her strain during the experiment is greater. . . . The circumstances grow more complicated if some of the people present do not believe in the success of the experiment or are sceptical of the results. Sometimes, although conditions seem favourable and the subject tried hard to carry out the experiment, the necessary psychological state could not be produced in the subject. In some cases the subject could identify those present who were hindering this by concealed doubts and scepticism. Provided that they then left the room, an atmosphere of confidence could be created and the experiment completed successfully. If after this initial success, witnessed by all present, the sceptics were readmitted, their presence no longer impeded results. (Kulagin 1971, 57–58)

The correct psychological state of not only Kulagina, but also everyone present was very important to the success of the psychokinetic endeavors. According to the theory I am developing here, it is essential to adequately diminish or eliminate the individual and collective skepticism about whether such things as psychokinesis are possible before information can be adequately

manipulated to effect a “real-world” psychokinetic event. Once success has been achieved in certain contexts, the “beliefs” of those who observed the success might be enough to overcome the “doubts” of the skeptics. The limiting of successful psychokinesis to relatively light objects in the case of Kulagina may be both a function of what it was “believed” could be accomplished (it is perhaps easier to believe, at the deepest levels of the unconscious, that smaller and lighter objects can be affected) and the issue that perhaps it requires a higher degree of information manipulation to psycho-kinetically move a heavier object (weight being a measure of the entropy that needs to be overcome).

As a side note to the concept of gravity as an entropic force in a holographic system, essentially gravity would be equivalent to information decay. To maintain records in the form of data encoded on the holographic screen the data would have to be continually reinforced (perhaps by thought). But not only could it be reinforced, it could also be changed (either purposefully or inadvertently), and anyone accessing the record may receive varying degrees of veridical information depending on the context (in terms of an equivalence principle, if information can be added, then it can also be accessed and/or extracted or removed). This may explain aspects of psychical or mental paranormal phenomena (such as telepathy, retrocognition, and precognition) and also suggests that both the past and the future from a human perspective may be malleable as the information encoded on the holographic screen can be manipulated. For thought-producing and thought-receiving entities like us, the most easily accessible and manipulated information is that of the immediate local environment (local from our perspective, that is, close in time and space from an everyday perspective).

EASTER ISLAND AND PSYCHOKINESIS

Returning to the moai of Easter Island, is there any truth to the legends of mana? Were the moai moved paranormally, by a form of psychokinesis, at least in part? Observing the moai on the island, especially around the major quarry, I could not help but get the impression that they had at least in some cases been popped out or tossed out of their resting places, as if by some semichaotic force. It is almost as if parts of the island had been subject to a poltergeist-style phenomenon, with moai strewn about. Perhaps, and of course this is wild

speculation, once a moai was partially carved (more or less roughed out), it was moved out of its quarry spot paranormally. The final positioning and raising of the moai on an ahu (ceremonial stand) may have been accomplished by more normal means.

Easter Island was literally a world unto itself, isolated in space by thousands of kilometers and isolated in time by many centuries and millennia. Easter Island may have formed the perfect psychokinesis laboratory. The inhabitants developed their own collective psyche and worldview, one that was perfectly "believable" to them and that included the ability to manipulate data on the local holographic screen and thus accomplish psychokinetic feats on moai weighing tens of tons. The Easter Islanders may have had 100 percent, or nearly 100 percent, investment in the belief system of the island. We can think of the entire island being involved in a giant séance where everyone is a true believer. The resulting phenomena may have been well beyond the possibilities that most people can even entertain in our modern, Western-based, twenty-first century culture.

Pursuing further research concerning the island and its "mysteries" (an admittedly overused term, but one that seems genuinely applicable here), we have much to learn from this small, isolated spot in the Pacific. Easter Island and its world prior to European contact may have been very different, at a deep level, from that which most people today perceive as reality. Indeed, it may have been so different that it is extremely difficult, if not virtually impossible, to fully grasp. However, in trying to comprehend the lost world of Easter Island, we open up new possibilities and begin to expose the assumptions, beliefs, and biases that prevent us from truly understanding the ultimate nature of reality. I can think of nothing that is more profound and worthwhile.

APPENDIX 5

DID A COMET HIT EARTH AT THE BEGINNING OF THE YOUNGER DRYAS, CIRCA 10,900 BCE?

In 2007 an article was published in the prestigious *Proceedings of the National Academy of Sciences of the United States of America* titled "Evidence for an Extraterrestrial Impact 12,900 Years Ago that Contributed to the Megafaunal Extinctions and the Younger Dryas Cooling" (Firestone *et al.* 2007). In this paper Richard Firestone, a physicist at Lawrence Berkeley National Laboratory in California, and his twenty-five coauthors suggested that circa 10,900 BCE a comet exploded over North America, killing off the mammoths and other animals and bringing the culture of the Paleo-Indian people that inhabited the region (known as the Clovis culture) to an end. Furthermore, they suggested that the dust and debris scattered into the atmosphere had a strong cooling effect, setting off the global Younger Dryas cold snap that would last for the next dozen centuries. The evidence they offered in support of this hypothesis included a carbon-rich black layer, sometimes referred to as the black mat, found in many areas at the Younger Dryas lower boundary (that is, it dates to circa 10,900 BCE). This black mat, according to the authors, contains "(*i*) magnetic grains with iridium, (*ii*) magnetic microspherules, (*iii*) charcoal, (*iv*) soot, (*v*) carbon spherules, (*vi*) glass-like carbon containing nanodiamonds, and (*vii*) fullerenes [hollow molecules formed from carbon that can be spherical, tubular, or ellipsoid] with ET [extraterrestrial] helium, all of which are evidence for an ET impact and associated biomass burning at [approximately] 12.9 ka [12,900 years ago]" (Firestone *et al.* 2007, 16016).

Taken together, the evidence cumulatively is very suggestive of the debris and aftereffects of a comet explosion.

Yet, not everyone was convinced. Archaeologists Vance T. Holliday, of the University of Arizona, and David J. Meltzer, of Southern Methodist University,

studying over forty Paleo-Indian sites, argued that the evidence for an extraterrestrial impact was, at best, nondefinitive. Holliday stated, “Whether or not the proposed extraterrestrial impact occurred is a matter for empirical testing in the geological record. Insofar as concerns the archaeological record, an extraterrestrial impact is an unnecessary solution for an archaeological problem that does not exist” (Holliday, quoted in Harrison 2010).

Mark Boslough, a physicist at Sandia Laboratory in Albuquerque, New Mexico, has been quoted as saying, “It is an impossible scenario” (Boslough, quoted in Dalton 2011).

Interestingly, even oddly, the argument over what happened on Earth nearly thirteen thousand years ago may involve modern politics. There are clear indications that part of the issue is the fact that the comet scenario, wherein an extraterrestrial event causes major climate change, is seen by some as a possible rationale to dismiss the consensus view that current global warming is due to human activity. As Wallace Broecker, a geochemist at Columbia University who is internationally known for his contributions to climate research, stated, “Those who don’t believe in human-produced global warming grab onto it [the comet theory]” (Broecker, quoted in Dalton 2011).

But the issues go deeper in this case, with allegations of nonreplicability, misrepresentation, and what essentially might be considered fraud.

Other researchers have attempted to replicate parts of the work carried out by Firestone *et al.* (2007), such as collecting and analyzing samples from the lower boundary of the Younger Dryas, and in some cases they have not found the same telltale markers (as described above) that the Firestone group reported. This has resulted in charges that the Firestone team’s work cannot be replicated (Dalton 2011). Replication is often seen as the hallmark of modern science. In fact, this may be a somewhat misleading contention, as when it comes to certain types of phenomena, the results may not always be easily replicated. Assuming that a comet did explode over North America circa 10,900 BCE, chunks of debris would not necessarily scatter evenly over all areas. Large chunks might be thrown in particular directions, and smaller dust and debris would be carried by the winds (and possibly the magnetic field of Earth in the case of very small metallic particles) and be deposited preferentially in certain locations. Therefore,

one site may contain an abundance of evidence diagnostic of a comet explosion, whereas another site may lack such evidence. However, it should be noted that other groups of researchers have been able to find evidence similar to that first reported by Firestone *et al.* (2007), thus supporting and supplementing the comet hypothesis (Mahaney *et al.* 2010; Kurbatov *et al.* 2010; Boyle 2012; Israde-Alcántara *et al.* 2012).

But the allegations against the Firestone group go deeper still, and much of the controversy is focused specifically on one of the major authors, Allen West, who was given the second spot in the authorship list on the 2007 paper. Apparently much of the primary fieldwork for the paper, collecting sediment samples from over two dozen archaeological sites, was carried out by West, and the integrity of that work has been called into question. For instance, a carbon spherule, provided by West and independently dated using radiocarbon methods, that was claimed to be from the lower Younger Dryas boundary layer and should have been 12,900 years old turned out to be only two hundred years old (Dalton 2011). It is also alleged that the Firestone group misidentified supposed nanodiamonds and that their carbon spherules may represent fungus residue or insect excrement rather than evidence for a comet explosion.

Returning to Allen West, his background does not help the cause of the Firestone comet hypothesis in the eyes of the critics. Prior to changing his name to Allen West in 2006, he was Allen Whitt, who in 2002 was convicted in California for his part “in a scheme with two other men, with court records saying they collected fees up to $39,500 for questionable groundwater reports. He originally was charged with two felonies for falsely representing himself as a state-licensed geologist but agreed to a no contest plea to a single misdemeanor of false advertising as part of [a] plea bargain in which state records say he was fined $4,500” (Dalton 2011; word in brackets added by R. Schoch).

Such a past history of criminal activity does not necessarily mean that West cannot do good science today or that the comet hypothesis with which he is linked is wrong, but West’s background certainly does not help his cause either. It only adds fuel to the controversy and allows the critics to launch personal ad hominem attacks, whether justified or not.

Ultimately, at this point I believe that, looking at all of the evidence, there is a

very strong argument that catastrophic events of an extraterrestrial nature occurred at both the beginning (circa 10,900 BCE) and end (circa 9700 BCE) of the Younger Dryas. The evidence strongly suggests a major solar outburst and plasma event at 9700 BCE. Whether the 10,900 BCE event was due to a comet exploding, a solar outburst and plasma event, a galactic superwave, or some other catastrophic event is yet to be determined. Possibly it was due to a solar outburst, one that was either of a different nature than, or not as powerful as, the solar outburst of 9700 BCE, such that rather than warming the atmosphere and Earth with a tremendous blast of energy, it (while greatly exceeding any solar outburst seen in modern times, including the Carrington Event) strongly ionized the atmosphere and thus caused increased cloud cover, which in turn initiated a major cooling spell. It is also conceivable, in my opinion, that in some cases comet impacts on Earth and solar outbursts could be correlated, for instance, in a situation where "space debris" enters the solar system, some of which hits the Sun, resulting in solar destabilization and increased solar activity, and some of the debris also hits Earth directly as a comet or meteorite.

In June 2012 further evidence was put forward in support of a cosmic impact at the beginning of the Younger Dryas. Richard Firestone, Allen West, and other coauthors published evidence of vitrified rock (melt-glass material and siliceous scoria-like objects) from Pennsylvania, South Carolina, and Syria, which they suggest could be the result of a comet or meteor (Bunch *et al.* 2012; Science Daily 2012). Alternatively, I suggest a solar outburst/plasma discharge as a possibility for the vitrified rock (see Records Engraved on Rocks in chapter 6 and chapter 11). In some cases the error ranges for the dating of the samples these authors analyze is on the order of 1,200 to 1,600 years, so it is possible that some of their samples pertain not to the beginning of the Younger Dryas but to its end.

A NOTE ON THE RECONSTRUCTION OF SOLAR ACTIVITY THROUGH GEOLOGICAL TIME

Solar activity can be reconstructed in various manners, such as by using ^{10}Be and ^{14}C data from ice cores, sediment cores, and dendrochronological sequences (Vonmoos *et al.* 2006). In essence the principle is that incoming cosmic rays in our atmosphere produce ^{10}Be, ^{14}C, and other radionuclides (see Nikitin *et al.*

2005), but when the Sun is active it sweeps away cosmic rays, and thus lower counts of these isotopes correlate with a more active Sun.

In private communication to me (see Schoch 2010c), a critic of Peratt's work (Peratt 2003; Peratt *et al.* 2007; Peratt and Yao 2008; van der Sluijs and Peratt 2010) has argued against the concept of powerful plasma phenomena affecting Earth during the last twelve thousand years based on the ^{10}Be and ^{14}C data. This critic assumes that a powerful plasma event would last a century or more and would therefore significantly interfere with the production of ^{10}Be and ^{14}C in the atmosphere, meaning that these isotopes should show a perceptible decrease in ice cores and other stratigraphic sequences (relative to the "background" levels of the time) whenever such major plasma events occurred. This critic cites a study (Vonmoos *et al.* 2006) that, according to him, failed to record significant drops in ^{10}Be and ^{14}C during the last twelve thousand years. He therefore concluded that major plasma events, as suggested by Peratt and his colleagues, did not occur. However, I believe he has made incorrect assumptions and misinterpreted the data.

This critic assumes that a powerful plasma event would last a century or more and therefore would have a significant effect on the production of ^{10}Be and ^{14}C. In my hypothesis, a major plasma event might only last on the order of days to months. The Carrington Event of 1859 lasted only a few days and would probably not be picked up in the type of records of isotope production this critic cites (the paper he cites does not include pertinent details for the nineteenth century). In my assessment, even a plasma event orders of magnitude larger than the Carrington Event, if it was of very short temporal duration, may not be easily resolved (if at all) in the isotope records that we currently have; isotope production would be relatively high before and after the event, and the lack of production for a few days (or even months or possibly years) in a record from thousands of years ago would be very difficult to impossible to detect. Finding such a short-term dip in the isotopes is much more difficult that finding a spike, such as the iridium and associated spikes that can be indicative of major meteor, comet, and asteroid impacts.

Furthermore, the particular study the critic cites (Vonmoos *et al.* 2006) does not appear to me to support his assertions. The study goes back slightly over nine thousand years for ^{10}Be and it goes back 11,450 years for ^{14}C, and it shows spikes in solar activity at about 9400 BCE, 8900 BCE, 8300 BCE, and 8000

BCE (as well as spikes since then), all well above current solar activity.

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In the early 1990s, Robert Schoch's geological analyses of the Great Sphinx demonstrated that the statue is thousands of years older than the conventional dating of 2500 BCE, bringing him worldwide fame. He is featured in the Emmy-winning documentary *The Mystery of the Sphinx*, which first aired on NBC and has been subsequently broadcast on numerous channels both in the United States and abroad.

A featured speaker at international conferences and symposia, Schoch's work has been instrumental in spurring renewed attention to the interrelationships between geological and astronomical phenomena, natural catastrophes, and the early history of civilization. Besides *The Mystery of the Sphinx*, he has appeared on many radio and television shows. He has contributed to magazines, journals, and reviews, and he is the author, coauthor, and/or editor of a number of books, both technical and popular, including *Phylogeny Reconstruction in Paleontology*, *Stratigraphy: Principles and Methods*, *Voices of the Rocks*, *Voyages of the Pyramid Builders*, *Pyramid Quest*, *The Parapsychology Revolution*, and the university textbook *Environmental Science: Systems and Solutions*. Robert Schoch's website is

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